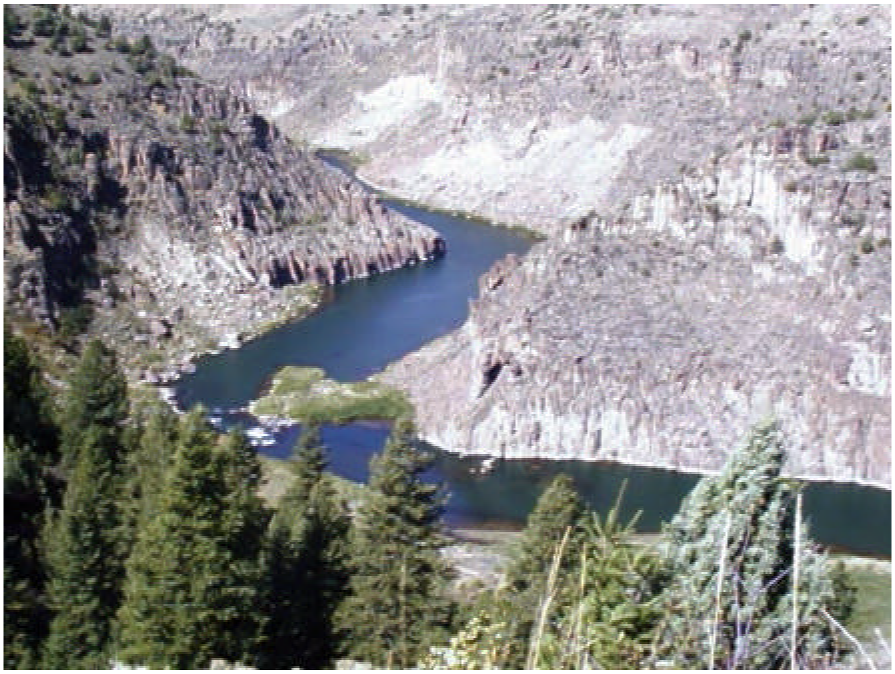
Teton River Subbasin Assessment
And
Total Maximum Daily Load



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Department of Environmental Quality

January 10, 2003

TETON SUBBASIN TOTAL MAXIMUM DAILY LOADS

INTRODUCTION

The goal of a TMDL is to restore an impaired waterbody to a condition that meets state water quality standards and supports designated beneficial uses. A TMDL is the sum of the individual wasteload allocations for point sources of a pollutant, load allocations for nonpoint sources and natural background levels, and a margin of safety. Because of the variety of ways in which nonpoint source pollutants may enter a waterbody, a TMDL must also address seasonal variations in pollutant loading and critical conditions that contribute to pollutant loading.

The approach used to develop a TMDL incorporates several assumptions regarding our knowledge of natural systems and human-caused changes in natural systems. Some of these assumptions are:

1. The amount of a pollutant that can be assimilated by a waterbody without violating water quality standards and impairing beneficial uses is known and can be quantified.

2. Natural background levels of a pollutant are known or can be determined.

3. Violations of water quality standards or impairments of beneficial uses can be directly linked to a single pollutant.

4. The data required to develop a load for a particular waterbody is available or can be readily obtained.

None of these assumptions were valid for waterbodies in the Teton Subbasin. Region 10 EPA acknowledges the uncertainty associated with these assumptions, and has proposed an adaptive management strategy for addressing this uncertainty (EPA 2000).

An adaptive management TMDL emphasizes near-term actions to improve water quality and can be employed when data only weakly quantify links between sources, allocations, and in-stream targets (EPA 2000). As explained in the subbasin assessment portion of this document, limited water quality data were available for the §303(d)-listed stream segments in the Teton Subbasin. Although LAs have been developed for most of these segments, these allocations are based on information gathered more than 10 years ago. Due to improved farming practices (e.g., elimination of summer fallow in the Teton Valley) and changes in land use, pollutant sources and resource concerns have changed somewhat. An adaptive management strategy makes provisions for addressing the effects that these and future changes may have on LAs during the implementation phase of the TMDL.

The adaptive management strategy will be incorporated into the TMDL implementation plan developed by designated management agencies. The designated roles of numerous government agencies in implementing Idaho's nonpoint source management program and TMDLs are described in the *Idaho Nonpoint Source Management Plan* (DEQ 1999b). An implementation plan for privately owned agricultural lands will be developed by the Soil Conservation Commission and Idaho Association of Soil Conservation Districts in cooperation with the Madison Soil and Water Conservation District, TSCD, and the Yellowstone Soil Conservation District, with technical support from the affiliated field offices of the NRCS. Implementation plans for publicly owned lands in the Teton Subbasin will be the responsibilities of the Idaho Department of Lands, U.S. Forest Service, BLM, and BOR. Within 18 months of approval of the *Teton Subbasin Assessment and Total Maximum Daily Load (TMDL)* by the EPA, the Idaho Falls Regional Office of DEQ will review each implementation plan and facilitate coordination among designated agencies to integrate the plans into a single, comprehensive implementation plan.

To conform with an adaptive management strategy (EPA 2000, EPA 2001), the implementation plan will include the following elements:

1. An action plan for implementing best management practices to address specific pollutants and pollutant sources. The action plan will include goals, milestones for achieving goals and consequences if milestones are not met. The plan will also include a description of expected improvements and an explanation of how improvements will restore water quality or beneficial uses.

2. A monitoring plan to "...assess progress toward goals and to gather additional information to better characterize pollutant sources and pathways, so as to improve the system of pollutant controls for a watershed information" (EPA 2000). The monitoring plan will include clearly stated, testable hypotheses for assessing the effectiveness of best management practices (EPA 2001).

3. An evaluation plan for "...the periodic review of monitoring results and milestone attainment" (EPA 2000).

4. An estimate of the costs of the implementation plan and possible funding sources.

In adopting an adaptive management strategy for the *Teton Subbasin TMDL Implementation Plan*, the Idaho Falls Regional Office of DEQ and the designated management agencies agree to the following concepts, which were adapted from the *Upper Grande Ronde River Sub-Basin Total Maximum Daily Load (TMDL)*, published by the Oregon Department of Environmental Quality in April 2000:

1. The goal of the CWA and IDAPA 58.01.02 is that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. This is a long-term goal in many watersheds, particularly where nonpoint-source pollutants are the main concern, but implementation must commence as soon as possible.

2. Total Maximum Daily Loads (TMDLs) are numerical loadings that are set to limit pollutant levels such that in-stream water quality standards are met. The Department recognizes that TMDLs are values calculated from mathematical models and other analytical techniques designed to simulate and/or predict very complex physical, chemical and biological processes. Models and techniques are simplifications of these complex processes and, as such, are unlikely to produce an exact and accurate prediction of how streams and other waterbodies will respond to the application of various management measures. It is for this reason that the TMDL has been established with a margin of safety.

3. Implementation Plans are designed to reduce pollutant loads from nonpoint sources to meet TMDLs. The Department recognizes that it may take some period of time, from several years to several decades, after full implementation before management practices in an Implementation Plan become fully effective in reducing and controlling nonpoint-source pollution. In addition, the Department recognizes that technology for controlling nonpoint-source pollution is, in many cases, in the development stages and that it may take one or more iterations before effective techniques are found. It is possible that after application of best management practices, some TMDLs or their associated surrogates cannot be achieved as originally established.

4. The Department also recognizes that, despite the best and most sincere of efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated surrogates. Such events could be, but are not limited to, floods, fire, insect infestations, and drought. Likewise, the Department recognizes that the rate of adoption of some best management practices by agricultural producers may be affected by economic factors beyond the control of producers. Severe and unusual economic stress in the agricultural economy may delay the implementation of best management practices within the watershed.

5. Pollutant surrogates may be defined as alternative targets in the Implementation Plan for meeting the TMDL. The purpose of the surrogates is not to bar or eliminate human access or activity in the basin or its riparian areas. However, it is the expectation that the Implementation Plan will address how human activities will be managed to achieve the surrogates.

6. The Department intends to regularly review progress of the Implementation Plan to achieve the goal of the TMDL, which is restoration and maintenance of beneficial uses. If and when the Department determines that a Plan has been fully implemented, that best management practices have reached maximum expected effectiveness and a TMDL or its interim targets have not been achieved, the Department shall reopen the TMDL and adjust it or its interim targets as necessary to support beneficial uses.

7. The implementation of TMDLs and the associated management plans is generally enforceable by the Department, other state agencies and local government. However, it is envisioned that sufficient initiative exists to achieve water quality goals with minimal enforcement. Should the need for additional effort emerge, it is expected that the designated agencies will work with land managers to overcome impediments to progress through education, technical support or enforcement. Enforcement may be necessary in instances of insufficient action towards progress. This could occur first through direct intervention from designated management agencies, and secondarily through DEQ. The latter may be based in Departmental Orders to implement management goals leading to water quality standards.

8. In employing an adaptive management approach to the Implementation Plan of this TMDL, DEQ has the following expectations and intentions:

    a) Subject to available resources, the Idaho Falls Regional Office of DEQ will review the progress of the TMDL and Implementation Plan on a regular basis. This review will be conducted with assistance from the Henry's Fork Watershed Council, acting in its designated role as Watershed Advisory Group (WAG) to DEQ;

    b) The Department expects that each management agency will also monitor and document its progress in implementing the provisions of its component of the Implementation Plan. This information will be provided to DEQ for its use in reviewing the TMDL;

    c) As the Implementation Plan is executed, DEQ expects that management agencies will develop benchmarks for attainment of TMDL surrogates, which can then be used to measure progress; and

    d) Where implementation of the TMDL or effectiveness of management techniques are found to be inadequate, DEQ expects management agencies to revise the components of the Implementation Plan to address these deficiencies.

CONCLUSIONS

One of the objectives of the subbasin assessment was to determine water quality management needs in the Teton Subbasin, including identification of waterbodies that:

1. Require development of a TMDL

2. May be removed from the 1998 §303(d) list because they are not impaired

3. May be deferred for TMDL development until a later date

4. Are not subject to TMDL development because the pollutant responsible for impairment is habitat modification or flow alteration

5. Are candidates for §303(d) listing

Based on information contained in the subbasin assessment, sediment TMDLs have been developed for Badger, Darby, Fox, Packsaddle, South Leigh, and Spring (including North Leigh) Creeks; for the Teton River from Trail Creek to Bitch Creek; and for the North Fork Teton River (Table 31). Nutrient TMDLs have also been developed for the Teton River from Highway 33 to Bitch Creek and the North Fork Teton River. Three TMDLs were rescheduled and will be completed for submittal to EPA by December 31, 2002. The rescheduled TMDLs are Moody Creek for nutrients, and Fox and Spring Creeks for temperature.

Segments of waterbodies that will be added to Idaho's 2002 §303(d) list of water quality impaired waterbodies requiring TMDL developments are shown in Table 32. According to the draft settlement agreement issued by DEQ for public review and comment on January 25, 2002 (available on the Internet at http://www2.state.id.us/deq/water/water1.htm#TMDLs), TMDLs for these waterbodies will not be due to the EPA until after the current scheduled TMDLs are completed in 2007. It is possible that instead of developing a temperature TMDL for the Teton Canyon section of the Teton River, the beneficial use of this segment will be redesignated from cold water aquatic life to seasonal cold water aquatic life. This determination will also be deferred until after completion of the current TMDL schedule.

SEDIMENT TMDLS

Loading Capacity

A sediment yield study conducted in 1992 indicated that natural sediment yields for the upper Teton River, headwaters to Spring Creek, were 32,600 tons/year (USDA 1992). This value is similar to the upper Teton River's water column carrying capacity of TSS (28,758 tons/year) based on an average annual flow of 409 cfs (USGS Station #13052200) and a TSS target of 80 mg/L. The USDA (1992) study also predicted the 1992 current sediment yield for this portion of the Teton River, which we will presume is the existing load in this TMDL. Under this assumption, the loading capacity for this upper portion of Teton River is somewhere in between the natural yield of 32,600 tons/year and the 1992 current yield of approximately 180,000 tons/year predicted in the USDA (1992) study.

Loading rates for most listed tributaries to the upper Teton River were also described in the USDA (1992) study. Sediment reductions in these tributaries are related to the overall sediment reductions necessary for the river itself.

Table 31. Status of TMDL development for stream segments in the Teton Subbasin that appeared on Idaho's 1998 §303(d) list.

Waterbody (WQLS#) and Boundaries	Pollutant(s)	Actions
Badger Creek (2125) Highway 32 to Teton River	Sediment	Allocate sediment load; reassess beneficial use support in segments that are not naturally dry or dewatered by legal diversions.
Darby Creek (2134) Highway 33 to Teton River	Sediment Flow alteration	Allocate sediment load; reassess beneficial use support in segments that are not naturally dry or dewatered by legal diversions. No TMDL for flow alteration per DEQ policy.
Fox Creek (2136) Wyoming Line to Teton River	Sediment Temperature Flow alteration	Allocate sediment load; reassess beneficial use support in segments that are not naturally dry or dewatered by legal diversions. Reschedule temperature TMDL until December 31, 2002, and continue monitoring. No TMDL for flow alteration per DEQ policy.
Horseshoe Creek (2130) Confluence of North and South Forks to Teton River	Flow alteration	No TMDL for flow alteration per DEQ policy. Change lower boundary to lower extent of perennial flow in future §303(d) list.
Moody Creek (2119) National Forest boundary to Teton River	Nutrients	Reschedule nutrient TMDL until December 31, 2002. Change upper boundary of listed segment to confluence of North and South Moody Creeks and lower boundary to Woodmansee Johnson Canal in future §303(d) list.
North Leigh Creek (5230) Wyoming line to Spring Creek	Unknown [1]	Assessment based on BURP data inappropriate because of intermittent flow. No TMDL required. However, watershed is part of Spring Creek in TMDL analysis.
Packsaddle Creek (2129) Headwaters to Teton River	Sediment Flow alteration	Allocate sediment load; reassess beneficial use support in segments that are not naturally dry or dewatered by legal diversions. Change lower boundary of listed segment to pipeline diversion in future §303(d) list. No TMDL for flow alteration per DEQ policy.
South Leigh Creek (2128) Headwaters to Teton River	Sediment	Allocate sediment load; reassess beneficial use support in segments that are not naturally dry or dewatered by legal diversions. Change upper boundary of segment to springs on west side of Highway 33 in future §303(d) list.
Spring Creek (2127) Wyoming line to Teton River	Sediment Temperature Flow alteration	Allocate sediment load. Reschedule temperature TMDL until December 31, 2002 and continue monitoring flow. Reassess beneficial use support in segments that are not naturally dry or dewatered by legal diversions. Change upper boundary of segment to North Leigh Creek and lower boundary to point at which flow becomes intermittent in future §303(d) list.
Teton River (2116) Highway 33 to Bitch Creek	Sediment Habitat alteration Nutrients	Allocate sediment and nutrient loads. No TMDL for habitat alteration per DEQ policy.
Teton River (2118) Headwaters to Trail Creek	Habitat alteration	No TMDL for habitat alteration per DEQ policy.
Teton River (2117) Trail Creek to Highway 33	Sediment Habitat alteration	Allocate sediment load. No TMDL for habitat alteration per DEQ policy.
North Fork Teton River (2113) Forks to Henry's Fork	Sediment Nutrients	Allocate sediment and nutrient loads.

[1]A pollutant source was not identified for segments added to the 1998 list because they were assessed as water quality impaired using BURP data.

Table 32. Stream segments that will be added to Idaho's 2002 §303(d) list of water quality impaired waterbodies requiring development of TMDLs.

Waterbody and Boundaries	Pollutant(s) of Concern	Basis for Listing
Moody Creek Confluence of North and South Moody Creeks to the Woodmansee Johnson Canal	Sediment Temperature	Caribou-Targhee National Forest fish habitat inventory data; Madison Soil and Water Conservation District water quality data; DEQ data
North Moody Creek Headwaters to confluence with South Moody Creek	Sediment Temperature	Caribou-Targhee National Forest fish habitat inventory data; DEQ data
South Moody Creek Headwaters to confluence with North Moody Creek	Sediment Temperature	Caribou-Targhee National Forest fish habitat inventory data; DEQ data
Fish Creek Headwaters to confluence with South Moody Creek	Sediment	Caribou-Targhee National Forest fish habitat inventory data; DEQ data
Teton River Confluence of Badger Creek to Teton Dam site	Temperature	BOR data collected in 1998 (Bowser 1999)

In order to complete this TMDL, the natural sediment yield will be used as an indicator of load differences. However, in no way should it be concluded that the natural yield is the loading capacity. An adaptive management approach will be used to provide reductions in sediment loadings based on usage of best management practices, coupled with data collection and monitoring to determine the loading point at which beneficial uses are fully supported in the river.

As part of the process of determining loading capacity and beneficial use support, sediment related targets will be used to provide evidence of sediment load reductions. In particular, percent fines, cobble embeddedness, and percent bank stability will be monitored and compared to existing data in an effort to monitor trends in sediment reduction.

Sediment Targets

The goal of the sediment TMDL is to restore and maintain the beneficial uses of cold water aquatic life and salmonid spawning by achieving the following targets: reduce the percentage of subsurface sediment in potential spawning areas to 27% or less for particles less than 6.3 mm in diameter and 10% or less for particles less than 0.85 mm in diameter, and increase streambank stability to 80% or more in any 100-meter (328-foot) section. Measurement of subsurface sediment can readily be accomplished in wadeable streams, but it is probably not possible to measure subsurface fine sediment in the Teton River because of the depth of the water column. Targets that can be measured in the water column have therefore also been proposed. These include turbidity not greater than 50 NTU instantaneous or 25 NTU for more than 10 consecutive days above baseline background, per existing Idaho water quality standards; chronic turbidity levels not to exceed 10 NTU at summer base flow; and TSS not to exceed 80 mg/L. These targets do not preclude the use of alternative surrogate measures and benchmarks for monitoring reductions in sediment yield to the Teton River and its tributaries during the implementation phase of the TMDL.

Existing Loading

The USDA (1992) study produced an estimate of current sediment yield for the upper Teton River at 179,683 tons/year (Table 33). This estimate is based on the universal soil loss equation analysis for sheet and rill erosion on croplands (about 20% of the land area) and PSIAC (1968) methods for non-croplands (USDA 1992). Included in the analysis, but not reported, were estimates from timber cutting operations, roads and trails, livestock use, and mass wasting. Estimates of streambank erosion sediment yields are itemized separately in Table 33. The method estimated a quantity for sediment yield for each subwatershed area. A percentage of the sediment was then transported through the subwatershed to its outlet on the Teton River. Additionally, drainage patterns, overbank flooding, ponding, lack of sufficient flow, and irrigation diversions were all considered in assignment of sediment delivery ratios for each subwatershed.

Note that Table 33 provides estimates of loadings of sediment for the listed streams of Darby Creek, Fox Creek, Horseshoe Creek, Spring Creek (including North Leigh Creek), South Leigh Creek, Packsaddle Creek, and the upper Teton River to Highway 33. Listed streams for sediment not addressed in this 1992 study include the Teton River from Highway 33 to Bitch Creek, Badger Creek, and the North Fork Teton River.

Sediment yields for Badger Creek can be estimated based on relative size. The Badger Creek watershed is 37,587 acres in size, which is about 26% larger than the adjacent Spring Creek/North Leigh Creek watershed (27,962 acres, USDA 1992). If it were assumed that the two watersheds would have similar soils and land use, then sediment yields from Badger Creek would equal 26% more than Spring Creek, or 26,263 tons/year. If Badger Creek adds an additional 26,263 tons/year to the upper Teton River, then the total existing sediment yield to the Teton River from the headwaters to Bitch Creek is 205,946 tons/year. More data is being collected during the summer of 2002 to refine the estimate of sediment loadings to Badger Creek.

Table 33. Estimates of sediment yield for tributaries to the Upper Teton River, headwaters through Spring Creek (USDA 1992). Streams in bold are §303(d) listed for sediment.

Watershed Name (USDA 1992)	Current Yield (tons/year)			Alternative 2 (tons/year)			Alternative 3 (tons/year)		
	Land Use	Stream-bank	Total	Land Use	Stream-bank	Total	Land Use	Stream-bank	Total
Rammel Hollow	16,735		16,735	10,475		10,475	8,757		8,757
Spring Creek	17,148	3,696	20,844	11,820	2,391	14,211	10,610	1,417	12,027
S. Leigh Creek	12,311	2,917	15,228	8,477	1,882	10,359	6,994	1,275	8,269
Packsaddle Cr.	2,486	1,103	3,589	1,951	479	2,430	1,739	185	1,924
Dry Hollow	5,973		5,973	3,709		3,709	3,161		3,161
Horseshoe Cr.	18,517	2,188	20,705	14,816	1,367	16,183	12,723	542	13,265
No Name	11,293		11,293	7,713		7,713	5,963		5,963
Dry Creek	17,925	362	18,287	11,469	362	11,831	9,527	362	9,889
Teton Creek	2,024	4,392	6,416	1,738	2,948	4,686	1,538	1,890	3,428
Spring Creek II	3,073		3,073	2,253		2,253	1,817		1,817
Twin Creeks	4,457	1,641	6,098	3,355	1,026	4,381	2,979	367	3,346
Mahogany Cr.	4,210	1,746	5,956	3,635	1,208	4,843	3,407	665	4,072
Teton River	5,736		5,736	4,375		4,375	3,628		3,628
Foster Slough	227		227	194		194	173		173
Darby Creek	907	1,694	2,601	760	821	1,581	648	46	694
Bouquet Creek	1,502	336	1,838	1,329	157	1,486	1,244	89	1,333
Patterson Creek	2,122	506	2,628	1,869	375	2,244	1,759	263	2,022
Trail Creek	10,715	2,823	13,538	8,922	1,985	10,907	8,238	983	9,221
Fox Creek	1,430	1,906	3,336	960	1,080	2,040	817	132	949
Game Creek	1,807		1,807	1,743		1,743	1,678		1,678
Moose Creek	2,997	892	3,889	2,890	892	3,782	2,783	892	3,675
Drake Creek	968		968	635		635	554		554
Little Pine Cr.	2,406	1,100	3,506	2,165	908	3,073	2,057	526	2,583
Warm Creek	3,713	1,699	5,412	2,930	617	3,547	2,635	78	2,713
Totals	**150,682**	**29,001**	**179,683**	**110,183**	**18,498**	**128,681**	**95,429**	**9,712**	**105,141**

Sediment loading to the North Fork Teton River is also unknown. Presumably, sediment delivered to the upper Teton River may pass through and a certain percentage is delivered to the North Fork and the South Fork as upstream contribution. It is not known how much additional sediment Bitch Creek, Milk Creek, and Canyon Creek may add to the Teton River on its way to the North Fork diversion. However, for the purposes of this TMDL, it is assumed that deposition and diversion of sediment may offset additional sediment loading to the Teton River from these streams. Therefore, all the sediment loaded into the upper Teton River as estimated by the USDA (1992) study, plus our estimate from Badger Creek, will be transported to the North and South Forks of the Teton River. Because 40% of the average annual flow (see Figure 4) is diverted to the North Fork from the main Teton River, it is estimated that 40% of the 1992 current sediment yield will also be carried to the North Fork (40% of 205,946 tons/yr. = 82,378 tons/yr.). Additionally, streambank erosion from the North Fork Teton River was estimated in 2001 (see below) to be 7,144 tons/year (Table 34). Therefore, the existing sediment load to the North Fork is estimated to be 89,522 tons/year (82,378 + 7,144).

Load Allocations

Although there are two NPDES-permitted discharges (city of Driggs and Grand Targee Ski Area) above the Teton River, their influence is considered negligible. Driggs' discharge is to Woods Creek, a wetland complex 5 miles from the Teton River. The ski area's discharge is to a dry channel and all the effluent flow seeps into the ground before reaching any surface water. It is not expected that any sediment would reach the river from these sources. Hence, the wasteload allocation is considered to be zero. However, this is not to suggest that these discharges are not allowed to increase or that there is no reserve for future growth. They simply do not discharge to the listed streams.

All allocations will be directed towards nonpoint sources as a whole. Load allocations are derived for watersheds as a whole and are not derived for specific nonpoint sources.

The USDA (1992) study identified two "treatment" scenarios for the reduction of sediment yields in the upper subbasin. Alternative 2 (Table 33) included only nonstructural (e.g., conservation tillage practices, filter strips, grazing systems, etc.) techniques or best management practices for the control of erosion from nonpoint sources. Alternative 3 included both structural and non-structural best management practices. These practices include conservation tillage, chiseling and subsoiling, cross-slope farming, permanent vegetative cover, filter strips, fencing, planned grazing systems, streambank protection, pasture management, and proper grazing use. The application of these practices was anticipated to protect 75% of cropland acres in the Teton Valley, to reduce erosion rates to one and one-half times tolerable (T) levels, and to adequately protect all streambank erosion sites that can be treated with a combination of management or vegetative establishment practices (USDA 1992).

The current yield estimates from the study were 82% greater than natural yields (Table 35). Alternative 3, if implemented, would reduce this sediment yield estimate to 69% over natural levels.

The first phase of the TMDL would be to implement all of the structural and non-structural best management practices envisioned in Alternative 3 (USDA 1992). Implementing this phase would result in a 41% reduction in sediment yields (from 179,683 to 105,141 tons/year) for the upper Teton River, headwaters to (and including) Spring Creek (Table 36). If the same reduction potential is applied to the remaining portion of the Teton River to Bitch Creek, then total sediment yields need to be reduced from 205,946 to 121,508 tons/year. Sediment reductions estimated under Alternative 3 for other listed streams are also presented in Table 36. If the sediment loading to the North Fork Teton River is similarly reduced by 41%, the load allocation for the North Fork will be 52,818 tons/year (41% reduction of 89,522 tons/year).

Table 34. Summary of streambank erosion inventory data for all reaches of the North Fork Teton River.

Reach	Direct Reach Length (ft)	Stream Reach Length (ft)	Ratio of Stream to Direct Reach Length	Total Bank Length (ft)	Total Eroding Bank Length (ft)	Area of Eroding Bank (sq. ft)	Percentage of Total Bank Length Eroding (%)	Erosion Rate for Stream Reach (tons/year)
1	3,712	3,974	1.1	7,948	1,601	6,154	20	310
2	1,118	1,661	1.5	3,322	869	3,919	26	180
3	1,512	2,651	1.8	5,302	1,163	4,183	22	195
4	1,506	1,604	1.1	3,208	721	3,893	22	123
5	2,588	3,865	1.5	7,730	2,654	9,221	34	491
6	2,775	4,487	1.6	8,974	3,152	16,421	35	628
7	2,650	2,859	1.1	5,718	1,689	7,772	30	936
8	3,145	6,607	2.1	13,214	1,721	8,639	13	214
9	1,528	2,348	1.5	4,696	1,450	7,172	31	262
10	3,045	5,217	1.7	10,434	3,436	16,960	33	836
11	3,350	4,900	1.5	9,800	3,067	12,551	31	654
12	1,468	1,718	1.2	3,436	390	1,560	11	80
13	1,356	1,474	1.1	2,948	211	759	7	39
14	4,012	4,563	1.1	9,126	1,511	7,180	17	180
15	1,601	2,606	1.6	5,212	3,303	18,726	63	1,104
16	5,110	5,630	1.1	11,260	642	2,370	6	131
17	6,805	9,486	1.4	18,972	5,976	29,748	31	780
Total	**47,281**	**65,650**		**131,300**	**33,556**	**157,228**		**7,144**

Table 35. Estimates of sediment yield above natural conditions for the Upper Teton River, headwaters to Spring Creek.

Yield Scenarios	Sediment Yields (tons/year)	Percent over Natural Yield
Current (1992) Yield	179,683	82%
Alternative 2	128,681	75%
Alternative 3	105,141	69%
Natural Yield	32,600	--

Table 36. Estimated sediment reductions for §303(d) listed streams.

Subwatershed	WQLS[1] Number	Current Yield (tons/year)	Alternative 3 Yield (tons/year)	Reduction
North Fork Teton River	2113	89,522	52,818	41%
Upper Teton River to Bitch Creek	2116	205,946	121,508	41%
Upper Teton River to Spring Creek	2117 2118	179,683	105,141	41%
Badger Creek	2125	26,263	16,367	38%
Spring Creek	2127 5230	20,844	12,027	42%
South Leigh Creek	2128	15,228	8,269	46%
Packsaddle Creek	2129	3,589	1,924	46%
Horseshoe Creek	2130	20,705	13,265	36%
Darby Creek	2134	2,601	694	73%
Fox Creek	2136	3,336	949	72%

[1]Water quality limited segment

Sediment related targets will be monitored and beneficial uses will be assessed to determine the effects of such reductions. If beneficial uses are not fully supported and targets are not realized by this implementation, then further reductions will be necessary.

Margin of Safety

The margin of safety is considered implicit in the design of the sediment TMDL. Successive refinement following initial reductions will lead to the determination of loading capacity. An margin of safety associated with initial reductions would be meaningless, especially if further reductions are necessary to attain beneficial uses.

Seasonal Variation and Critical Time Periods in Sediment Loading

Sediment introduction into streams is pulsed and episodic in nature. It is likely that the majority of sediment moves with the spring snowmelt runoff and spring rains. However, these events can be variable in occurrence, with some springs wetter than others, and the timing of spring may vary depending on the variable weather. Also, much sediment can move in single catastrophic events that may not occur every year. By addressing average annual loadings, this variability is largely avoided. However, it must be realized that in any given year, sediment loadings may be much lower or much higher than the average loading predicted.

Streambank Erosion for the North Fork Teton River

The sediment load allocation for the North Fork Teton River was based on an estimate of the amount of sediment currently delivered to the channel from upstream contributions and through the process of streambank erosion. As explained in the subbasin assessment section of this document, sediment delivery from land surfaces in the North Fork Teton River subwatershed is negligible. Slopes are very low and the stream channel is constrained by levees in many areas. Loss of property has been a serious issue for landowners whose property borders sections of the river that were not reinforced following flooding caused by the collapse of the Teton Dam

The streambank erosion inventory was conducted from June 2001 through October 2001, as permission to access the river was obtained from landowners. All landowners granted permission, and streambanks along the 14-mile distance of the river were directly observed and measured except for a short distance in the final reach near the confluence with the Henry's Fork River where dense riparian vegetation prevented walking along the streambanks and water depths prevented walking through the stream channel. The erosion inventory was completed by personnel from the Idaho Association of Soil Conservation Districts and DEQ using procedures described in the *Stream Visual Assessment Protocol* (USDA 1998) and *Rapid Assessment Point Method* (USDA 2001).

Before direct measurements of the streambanks were made, the river channel was divided into 17 reaches based on the following criteria, as determined using 7.5-minute topographic maps and aerial photographs: locations of levees, roads, bridges, irrigation diversions, and canal discharges; and locations where the river channel had been modified or remained relatively natural. Crews of at least two people walked each stream reach. One person drew a diagram of the reach denoting streambank condition, locations of eroding streambanks, vegetation, locations of levees and roads, land use practices, and other relevant information. Another crew member measured the length and height of eroding banks in feet using a stadia rod. If the bank was on the opposite side of the channel and could not be reached by wading, the length and height of the eroding bank was estimated. For very long banks, height was measured at several points and an average bank height was recorded. Photographs of the banks were made for a permanent record of condition at the time of measurement.

An erosion rate for each streambank was calculated in pounds of soil per year by according to the following equation:

$$\text{Erosion Rate (pound/year)} = \text{Area of eroding bank (square feet)} \times \text{Average lateral recession rate (feet/year)} \times \text{Soil bulk density (pound/cubic feet)}$$

The area of eroding bank was calculated from measurements of bank height and length as described in the previous paragraph. The soil bulk density was determined by first determining the soil series for the streambank from soil survey maps and matching it to the soil bulk density listed in Table 37. The average lateral recession rate was determined by examining photographs and field notes and assigning the corresponding recession category using the descriptions shown in Table 38. The average recession rate that corresponded with the recession category was used to calculate erosion rate. For example, the average lateral recession rate for a steambank that met the description of severe recession was 0.4 feet/year, and the average lateral recession rate for a steambank that met the description of very severe recession was 1.25 feet/year. The erosion rate for each stream reach was then converted from pounds/year to tons/year by dividing by 2,000 pounds/ton. The erosion rates for each stream reach were then summed to obtain the erosion rate for the North Fork Teton River.

Table 37. Bulk densities of soils in the North Fork Teton River subwatershed.[1]

Soil Series	Texture	% Sand	% Clay	Bulk Density (g/cm^3)	Bulk Density (lb/ft^3)
Annis	Silty clay loam	10	27	1.31	81.8
Bannock	Loam	40	20	1.41	88.0
Blackfoot	Loam and silty clay loam	35	17	1.42	88.6
Labenzo	Silt loam	40	10	1.51	94.3
St. Anthony	Sandy loam shifting to sandy clay loam	65	20	1.46	91.1
Wardboro	Sandy loam shifting to loam	76	9	1.59	99.3
Withers	Silty clay loam	19	28	1.32	82.4

[1]Bulk densities were calculated by estimating the percentage of sand and clay in the soil, then inserting these numbers into the hydraulic properties calculator provided by K.E. Saxton of the USDA, Pullman, WA at Internet site http://www.bsyse.wsu.edu/saxton/soilwater/soilwater.htm?30,195.

The cumulative erosion rate for all reaches of the North Fork Teton River was 7,144 tons/year (Table 34). This value appears to be reasonable when compared to the load allocations for streambanks shown in Table 33.

Table 38. Descriptions and quantitative values for categories of lateral recession rates.

Category	Description	Lateral Recession Rate (feet/year)	Average Recession Rate (feet/year)	Lateral Recession Rate (inches/year)	Average Recession Rate (inches/year)
Slight	Some bare bank but erosion not readily apparent. No vegetative overhang. No exposed tree roots. Bank height minimal.	0.01 - 0.05	0.03	0.12 - 0.6	0.36
Moderate	Bank is predominantly bare with some vegetative overhang. Some exposed tree roots. No slumping evident.	0.06 - 0.2	0.13	0.72 - 2.4	1.56
Severe	Bank is bare with very noticeable vegetative overhang. Many tree roots exposed and some fallen trees. Slumping or rotational slips are present. Some changes in cultural features, such as missing fence posts and realignment of roads.	0.3 - 0.5	0.4	3.6 - 6	4.8
Very Severe	Bank is bare and vertical or nearly vertical. Soil material has accumulated at base of slope or in water. Many fallen trees and/or extensive vegetative overhang. Cultural features exposed or removed or extensively altered. Numerous slumps or rotational slips present.	0.5 - 2.0	1.25 (1.5 in original citation)	6 - 24	18
Extremely Severe	Bank is bare and vertical. Soil material has accumulated at base of slope and oftentimes still contains living grass or other vegetative material. Extensive cracking of the earth parallel to the exposed face above the bank. Generally evidence of "block-size" material that has either recently fallen in or is about to fall in. Can be "pillars" of soil materials that have already been loosened by stream and indicate imminent failure into the stream. Trees have been undercut and lie in stream, often with rootballs intact. (These rates should be verified with several observations or with actual streambank monitoring.)	2.0 - 5.0	3.5	24 - 60	42

NUTRIENT TMDLS

Loading Capacity and Targets

The North Fork Teton River, the upper Teton River (Highway 33 to Bitch Creek), and Moody Creek are §303(d) listed for nutrient pollution. The nutrient TMDL for Moody Creek will be completed by December 31, 2002, after nutrient data are collected during the summer of 2002.

The average annual flow of the upper Teton River at USGS Station #13052200 is 409 cfs (see Figure 4). Additional flow is added to the river from South Leigh Creek, Spring Creek, Badger Creek, and smaller tributaries by the time it gets to the Highway 33 to Bitch Creek segment. There are only two years of data (1975 and 1976) at USGS Station #13054200, Teton River below Badger Creek. Average annual flow for those two years was 750 cfs. Presumably average annual flows for the Teton River, Highway 33 to Bitch Creek segment, is somewhere between 409 cfs and 750 cfs. We conservatively estimate average annual flow to be the halfway point between these two measured values or 575 cfs.

A total phosphorus target of 0.1 mg/L (see Table 15) was used to determine a loading capacity of 113,202 pounds/year total phosphorus in the upper Teton River, Highway 33 to Bitch Creek. Likewise, a nitrate target of 0.3mg/L was used to determine a loading capacity of 339,606 pounds/year nitrate nitrogen in the same segment. The loading capacity for each is reduced by 10% for a margin of safety. Thus, the total phosphorus loading capacity will be 101,882 pounds/year, and the nitrogen loading capacity will be 305,645 pounds/year.

The average annual flow for the North Fork Teton River is 336 cfs (Figure 4). Using the same targets, the loading capacity for nitrogen and phosphorus in the North Fork is 198,448 pounds/year and 66,149 pounds/year, respectively. Reduced by a 10% margin of safety, the capacities become 178,603 pounds/year nitrate nitrogen and 59,534 pounds/year total phosphorus.

Existing Loading

Floyd Bailey, an agronomist referenced in the USDA (1992) study on upper Teton River sediment yield, indicated that each ton of cropland-generated sediment would contain about 3.0 pounds of nitrogen and 2.8 pounds of phosphorus. If we assume that 80% of the sediment delivered to a stream is cropland sediment (based on the ratio of land use to streambank yields), then the amount of nitrogen and phosphorus introduced into the upper Teton River (Highway 33 to Bitch Creek segment) is 494,270 pounds/year of nitrogen and 461,319 pounds/year of phosphorus. The existing load of nitrogen and phosphorus to the North Fork Teton River is 214,853 pounds/year nitrogen and 200,529 pounds/year of phosphorus. For simplicity, it is assumed that these parameters are equivalent to nitrate nitrogen and total phosphorus.

Load Allocation

Although there are two NPDES-permitted discharges (city of Driggs and Grand Targee Ski Area) above the Teton River, Highway 33 to Bitch Creek segment, their influence is considered negligible. Driggs discharge is to Woods Creek, a wetland complex 5 miles from the Teton River. The ski area's discharge is to a dry channel and all the effluent flow seeps into the ground before reaching any surface water. It is not expected that any nutrients would reach the river from these sources. Hence, the wasteload allocation is considered to be zero. However, this is not to suggest that these discharges are not allowed to increase or that there is no reserve for future growth. They simply do not discharge to the listed streams.

The entire allocation is attributed to nonpoint sources as a whole. No effort has been made to separate sources for load allocations. Because of the relationship between nutrient additions and sediment additions from land use, it is assumed that methods to reduce sediment pollution will likewise reduce nutrient pollution. Load reductions needed to meet target levels of nitrogen and phosphorus are on the order of 8% to 38% and 67% to 78%, respectively (Table 39).

Table 39. Load reductions necessary to meet loading capacity (minus 10% margin of safety) for the North Fork and upper Teton River (Highway 33 to Bitch Creek).

	Load Capacity (lb./yr.)	Existing Load (lb./yr.)	Reduction
North Fork Teton River (WQLS[1] Number = 2113)			
Nitrogen (nitrate)	198,448	214,853	8%
Total Phosphorus	66,149	200,529	67%
Upper Teton River, Highway 33 to Bitch Creek (WQLS Number = 2116)			
Nitrogen (nitrate)	305,645	494,270	38%
Total Phosphorus	101,882	461,319	78%

[1]Water quality limited segment

Margin of Safety

A 10% margin of safety has been used in the calculation of loading capacity to adjust for uncertainty related to nutrient load calculations.

Seasonal Variation and Critical Time Periods in Nutrient Loading

Phosphorus moves off the land with sediment. Thus, like sediment, phosphorus introduction into streams is pulsed and episodic in nature. It is likely that the majority of nutrients move with the spring snowmelt runoff and spring rains. However, these events can be variable in occurrence, as some springs are wetter than others. The timing of spring runoff may also vary depending on the variable weather. In addition, large quantities of sediment and nutrients can move in single catastrophic events that may not occur every year. By addressing average annual loadings, this variability is largely avoided. However, it must be realized that in any given year, nutrient loadings may be much lower or much higher than the average loading predicted.

The seasonal variations and critical time periods that influence loading of nitrogen associated with cropland-generated sediment are the same as those described above for phosphorus and have been included into the estimates for annual yields. Based on data reviewed in the subbasin assessment, nitrate loading is also influenced by seasonal plant growth and senescence. Instream concentrations of nitrates decrease during periods of optimal aquatic plant growth and increase during periods when plant growth is minimal and when plant material is decaying. In the Teton River upstream of the listed segment, nitrate concentrations may drop below 0.3 mg/L only in June, whereas in the lower Teton River, nitrate concentrations usually drop below 0.3 mg/L from May to September.

PUBLIC PARTICIPATION

The Teton subbasin assessment and TMDLs were developed with the cooperation and participation of the Henry's Fork Watershed Council as the designated Watershed Advisory Group; local, state, and federal agencies; and interested citizens throughout the basin and region over a three year period commencing in 1998.

The draft version of the *Teton Subbasin Assessment and Total Maximum Daily Load* report was available for public comment from March 5, 2001, through May 7, 2001. The draft was mailed to members of the Henry's Fork Watershed Council Water Quality Subcommittee and other interested parties. Copies were made available for review at the following locations: Valley of the Tetons Library in Victor, Victor City Hall, Teton County Courthouse in Driggs, USDA Service Center in Driggs, Madison Library District in Rexburg, Idaho Falls Public Library, and the DEQ Regional Office in Idaho Falls.

A public meeting to discuss the content of the Teton subbasin assessment and TMDL occurred on March 15, 2001, at DEQ's Idaho Falls Regional Office. A presentation regarding the TMDL was made on April 17, 2001, at the Henry's Fork Watershed Council meeting in Driggs, and an open house to discuss the TMDL was held the same day at the USDA Service Center in Driggs. Public notices advertising the availability of the draft, major conclusions, and request for comments were published in the *Idaho Falls Post Register*, *Teton Valley News*, and the *Rexburg Standard Journal* newspapers the duration of the comment period.

Comment were received from the Henry's Fork Watershed Council, Idaho Department of Lands-Eastern Idaho Area Office, USDA Caribou-Targhee National Forest-Teton Basin Ranger District, U.S. Department of the Interior Bureau of Reclamation-Snake River Area Office, and EPA Region 10 Idaho Operations Office.

A response to comments was prepared and will be provided under separate cover as an addendum to this document. The final *Teton Subbasin Assessment and Total Maximum Daily Load* was submitted to EPA in July 2002. The rescheduled portion is scheduled for submittal to EPA in December 2002 after public review and comment.

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GLOSSARY

§303(d)	Refers to section 303 subsection “d” of the Clean Water Act. 303(d) requires states to develop a list of waterbodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Anadromous	Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.
Anaerobic	Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.
Anti-Degradation	Refers to the U.S. Environmental Protection Agency’s interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water’s uses (IDAPA 58.01.02.003.56).
Aquatic	Occurring, growing, or living in water.
Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Bedload	Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.

Beneficial Use Reconnaissance Program (BURP) A program for conducting systematic biological and physical habitat surveys of waterbodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers

Best Management Practices (BMPs) Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.

Biological Oxygen Demand The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.

Biota The animal and plant life of a given region.

Biotic A term applied to the living components of an area.

Clean Water Act (CWA) The Federal Water Pollution Control Act (commonly known as as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.

Community A group of interacting organisms living together in a given place.

Criteria In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.

Cubic Feet per Second A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Depth Fines Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm).

Designated Uses Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.

Discharge The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).

Dissolved Oxygen	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.
Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia Coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving waterbody.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.
Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic Institute 1962).
Erosion	The wearing away of areas of the earth's surface by water, wind, ice, and other forces.
Exceedance	A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.
Existing Beneficial Use or Existing Use	A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Fecal Coliform Bacteria	Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria).

Flow	See Discharge.
Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).
Fully Supporting Cold Water	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997).
Fully Supporting but Threatened	An intermediate assessment category describing waterbodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status.
Geographical Information Systems (GIS)	A georeferenced database.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Habitat	The living place of an organism or community.
Headwater	The origin or beginning of a stream.
Hydrologic Basin	The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).
Hydrologic Unit	One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.
Hydrologic Unit Code (HUC)	The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.
Hydrology	The science dealing with the properties, distribution, and circulation of water.

Influent A tributary stream.

Inorganic Materials not derived from biological sources.

Instantaneous A condition or measurement at a moment (instant) in time.

Intergravel Dissolved Oxygen The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

Intermittent Stream 1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.

Interstate Waters Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.

Irrigation Return Flow Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.

Land Application A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.

Limiting Factor A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.

Load Allocation A portion of a waterbody's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing) The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

Loading Capacity A determination of how much pollutant a waterbody can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.

Macroinvertebrate An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500ìm mesh (U.S. #30) screen.

Macrophytes	Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.
Margin of Safety	An implicit or explicit portion of a waterbody's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving waterbody. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.
Metric	1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.
Milligrams per liter (mg/L)	A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).
Monitoring	A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a waterbody.
Mouth	The location where flowing water enters into a larger waterbody.
National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Natural Condition	A condition indistinguishable from that without human-caused disruptions.
Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed	A concept and an assessment category describing waterbodies that have been studied, but are missing critical information needed to complete an assessment.

Not Attainable	A concept and an assessment category describing waterbodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.
Oxygen-Demanding Materials	Those materials, mainly organic matter, in a waterbody that consume oxygen during decomposition.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Pathogens	Disease-producing organisms (e.g., bacteria, viruses, parasites).
Perennial Stream	A stream that flows year-around in most years.
Phased TMDL	A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a waterbody. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.
Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.

Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Reach	A stream section with fairly homogenous physical characteristics.
Reconnaissance	An exploratory or preliminary survey of an area.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Respiration	A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a waterbody.
River	A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.

Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Settleable Solids	The volume of material that settles out of one liter of water in one hour.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stratification	A Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.

Surface Fines	Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.
Surface Runoff	Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.
Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).
Threatened Species	Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Total Maximum Daily Load (TMDL)	A TMDL is a waterbody's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Wasteload Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several waterbodies and/or pollutants within a given watershed.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)	The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.
Toxic Pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Tributary	A stream feeding into a larger stream or lake.
Turbidity	A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.
Wasteload Allocation	The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a waterbody.
Waterbody	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Column	Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.
Water Pollution	Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.
Water Quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.
Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.

Water Quality Limited	A label that describes waterbodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a §303(d) list.
Water Quality Limited Segment (WQLS)	Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed."
Water Quality Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Standards	State-adopted and EPA-approved ambient standards for waterbodies. The standards prescribe the use of the waterbody and establish the water quality criteria that must be met to protect designated uses.
Water Table	The upper surface of ground water; below this point, the soil is saturated with water.
Watershed	1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a waterbody.
Waterbody Identification Number (WBID)	A number that uniquely identifies a waterbody in Idaho ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.
Young of the Year	Young fish born the year captured, evidence of spawning activity.

Appendix A. Section 303(d) of the Federal Water Pollution Control Act (Clean Water Act) as Amended, 33 U.S.C. §1251 *et seq.*

(d)(1)(A) Each State shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.

(B) Each State shall identify those waters or parts thereof within its boundaries for which controls on thermal discharges under section 301 are not stringent enough to assure protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife.

(C) Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

(D) Each State shall estimate for the waters identified in paragraph (1)(D) of this subsection the total maximum daily thermal load required to assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife. Such estimates shall take into account the normal water temperatures, flow rate, seasonal variations, existing sources of heat input, and the dissipative capacity of the identified water or parts thereof. Such estimates shall include a calculation of the maximum heat input that can be made into each such part and shall include a margin of safety which takes into account any lack of knowledge concerning the development of thermal water quality criteria for such protection and propagation in the identified water or parts thereof.

(2) Each State shall submit to the Administrator from time to time, with the first such submission not later than one hundred and eighty days after the date of publication of the first identification of pollutants under section 304(a)(2)(D), for his approval the water identified and the loads established under paragraphs (1)(A), (1)(B), (1)(C), and (1)(D) of this subsection. The Administrator shall either approve or disapprove such identification and load not later than thirty days after the date of submission. If the Administrator approves such identification and load, such State shall incorporate them into its current plan under subsection (e) of this section. If the Administrator disapproves such identification and load, he shall not later than thirty days after the date of such disapproval identify such waters in such State and establish such loads for such waters as he determines necessary to implement the water quality standards applicable to such waters and upon such identification and establishment the State shall incorporate them into its current plan under subsection (e) of this section.

(3) For the specific purpose of developing information, each State shall identify all waters within its boundaries which it has not identified under paragraph (1)(A) and (1)(B) of this subsection and estimate for such waters the total maximum daily load with seasonal variations and margins of safety, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculation and for thermal discharges, at a level that would assure protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife.

(4) Limitations on Revision of Certain Effluent Limitations--

(A) Standard Not Attained--For waters identified under paragraph (1)(A) where the applicable water quality standard has not yet been attained, any effluent limitation based on a total maximum daily load or other waste load allocation established under this section may be revised only if (i) the cumulative effect of all such revised effluent limitations based on such total maximum daily load or waste load allocation will assure the attainment of such water quality standard, or (ii) the designated use which is not being attained is removed in accordance with regulations established under this section.

(B) Standard Attained--For waters identified under paragraph (1)(A) where the quality of such waters equals or exceeds levels necessary to protect the designated use for such waters or otherwise required by applicable water quality standards, any effluent limitation based on a total maximum daily load or other waste load allocation established under this section, or any water quality standard established under this section, or any other permitting standard may be revised only if such revision is subject to and consistent with the antidegradation policy established under this section.

Appendix B. Background Information Regarding Development of the Idaho TMDL Schedule. Adapted from: Idaho Sportsmen's Coalition v. Browner, No. C93-943WD, (W.D. Wash. 1997) Stipulation and Proposed Order on Schedule Required by Court, April 7, 1997.

In 1993, two Idaho environmental groups filed suit in Federal Court against the U.S. Environmental Protection Agency (EPA) for violations of §303(d) of the Clean Water Act (CWA). The groups alleged that EPA improperly approved Idaho's 1992 §303(d) list because the list did not identify all waters violating state water quality standards [see *Idaho Sportsmen's Coalition v. Browner,* Case No. C93-943WD (W.D. Wash.)]. The plaintiffs also alleged that Idaho had failed to develop a sufficient number of total maximum daily loads (TMDLs) for Idaho's listed waters.

In April 1994, the court issued an order granting partial summary judgement to plaintiffs on their challenge to the list [see *Idaho Sportsmen's Coalition v. Browner, Id.* (W.D. Wash. April 14, 1994)]. The Court found that EPA's approval of Idaho's 1992 §303(d) list was arbitrary and capricious, because EPA "failed to offer a rational explanation for its approval of a list containing only thirty-six bodies of water" when there was "evidence showing that hundreds of waters were impaired or threatened". The court ordered EPA to publish a new list. In October 1994, EPA published a §303(d) list for Idaho that included 962 waterbodies.

In May 1995, the court ruled that EPA must establish a "complete and reasonable schedule" with the state of Idaho for TMDL development, as required by 40 CFR 130.7(d)(1). The court's May 1995 order described a reasonable schedule encompassing all listed waters as follows:

> "Such a schedule may provide more specific deadlines for the establishment of a few TMDLs for well-studied water quality limited segments in the short-term, and set only general planning goals for long term development of TMDLs for water quality limited segments about which little is known…"

In May 1996, DEQ and EPA proposed a TMDL development schedule for Idaho to the court. This proposal included a short-term schedule that provided specific dates to complete TMDLs for 41 water quality limited waters on the 1994 §303(d) list over a four-year period. The proposal also included a long-term plan, which consisted of additional evaluation of water quality for listed waters and a basin management approach to TMDL development for each of the six administrative basins in Idaho. EPA indicated that all required TMDLs would be completed within a 25-year time frame.

On September 26, 1996, the court found that the proposed schedule for TMDL development in Idaho "violates the CWA [Clean Water Act] because of two flaws. The first is its extreme slowness. ... The second flaw is that the proposed schedule makes no provision for TMDL development for the full list of Idaho WQLSs [water quality limited segments]". The remedy ordered by the court remanded the matter back to EPA with directions to:

> "establish with Idaho ... a complete and duly adopted reasonable schedule for the development of TMDLs for all waterbodies designated as WQLSs in Idaho. The present record, ... suggests that a completion time of approximately five years would be reasonable."

Appendix C. Active and Discontinued Gage Stations Operated by the U.S. Geological Survey in the Teton Subbasin.[1]

Station Name	Station Number	Drainage Area (mi^2)	Period of Record	Maximum Discharge and Date[2]	Maximum Unit Discharge (cfs/mi^2)[1]
Trail Creek near Victor, ID	13051000	47.6	1946-1952	445 cfs 6/7/52	9.3
Teton Creek near Driggs, ID	13051500	33.8	1946-1952	ND[3]	ND
Teton River near Driggs, ID	13052000	303	1935-1940	1,480 cfs 6/2/36	4.9
Teton River above South Leigh Creek near Driggs, ID	13052200	335	1962-Present	2,980 cfs 6/11/97	8.9
Horseshoe Creek near Driggs, ID	13052500	11.7	1946-1952	ND	ND
Packsaddle Creek near Tetonia, ID	13053000	6.8	1946-1950	58 cfs 5/19/49	8.5
Spring Creek near Tetonia, ID	13053500	--	1947-1949	10 cfs 3/19/47	--
Teton River near Tetonia, ID	13054000	471	1930-1957	1,900 cfs 6/28/45	4.0
Teton River below Badger Creek near Newdale, ID	13054200	547	1974-1977	2,700 cfs 7/7/75	4.9
Bitch Creek near Lamont, ID	13054300	80.9	1974-1977	1,880 cfs 7/7/75	23.2
Canyon Creek near Newdale, ID	13054500	68	1920-1939	457 cfs 5/21/25	6.7
Canyon Creek at Highway 33 near Newdale, ID	13054600	79.9	1974-1977	694 cfs 6/8/75	8.7
Teton Reservoir near Newdale, ID	13054800	851	1976	ND	ND
Teton River below Teton Dam near Newdale, ID	13054805	851	1974-1977	1,290 cfs 4/9/77	1.5
Teton River near St. Anthony	13055000	890	1890-Present	11,000 cfs 2/12/62	12.4
North Fork Teton River at Teton, ID	13055198	--	1908 1977-Present	2,590 cfs 5/22/93	ND
North Fork Teton River at Auxiliary Bridge, near Teton, ID	13055210	--	1977-1978	ND	ND
North Fork Teton River at Powerline Road, near Teton, ID	13055230	--	1977-1978	ND	ND
North Fork Teton River at Bridge, near Sugar City, ID	13055250	--	1977-1978	ND	ND
North Fork Teton River at Highway Bridge, near Salem, ID	13055270	--	1977-1978	ND	ND
North Fork Teton River at Last Bridge, near Salem, ID	13055300	--	1977-1978	ND	ND
Moody Creek near Rexburg, ID	13055319	--	1980-1983 1984-1986	ND	ND
South Fork Teton River at Rexburg, ID	13055340	--	1981-Present	3,410 cfs 5/16/84	ND
Diversion from Teton River between St. Anthony Gage and Mouth	13055500	--	1919-1977	ND	ND

[1]Sources for active and inactive stations: USGS data files available on the Internet at http://idaho.usgs.gov/swdata/active.gages.html and http://idaho.usgs.gov/swdata/disc.sw.list.html
[2]Source: England 1998
[3]ND: Not determined

Appendix D. Waterbody Units Comprising the Teton Subbasin: Recommendations Submitted by the Henry's Fork Watershed Council.

The Division of Environmental Quality revised IDAPA 16.01.02 in April 2000 to incorporate a waterbody identification system for the purpose of designating beneficial uses. The Henry's Fork Watershed Council reviewed the boundaries of waterbody units proposed for the entire Henry's Fork basin and submitted the following recommendations for the Teton Subbasin to the Division of Environmental Quality on August 2, 1999, as part of the official public record. After considering the public comments regarding Docket No. 16.01.02-9704, the DEQ Administrator issued a final version of the proposed rule. The final version, which is shown in Table 7 of the body of this document, was adopted by the Board of Health and Welfare on November 18, 1999, and by the Idaho State Legislature in 2000. At the same time, the legislature promoted the Division of Environmental Quality to a cabinet-level department, and the numbering assigned to rules pertaining to the department changed from IDAPA 16 to IDAPA 58.

Table D-1. Recommendations received by DEQ from the Henry's Fork Watershed Council for boundaries of waterbody units in the Teton Subbasin.

Unit	Waters
US-1	South Fork Teton River - Teton River Forks to confluence with Henry's Fork
US-2	North Fork Teton River -Teton River Forks to confluence with Henry's Fork
US-3	Teton River - Teton Dam to Teton River Forks
US-4	Teton River - Canyon Creek to Teton Dam
US-5	Moody Creek - confluence of North and South Fork Moody Creeks to canal
US-6	South Fork Moody Creek - source to confluence with North Fork Moody Creek
US-7	North Fork Moody Creek - source to confluence with South Fork Moody Creek
US-8	Canyon Creek - Warm Creek to confluence with Teton River
US-9	Canyon Creek - source to Warm Creek
US-10	Calamity Creek - source to confluence with Canyon Creek
US-11	Warm Creek - source to confluence with Canyon Creek
US-12	Teton River - Milk Creek to Canyon Creek
US-13	Milk Creek - source to confluence with Teton River
US-14	Teton River - Felt Dam Outlet to Milk Creek
US-15	Teton River - normal elevation of Felt Dam pool (5,530 feet) to Felt Dam Outlet
US-16	Teton River - Highway 33 bridge to normal elevation of Felt Dam pool (5530 feet)
US-17	Teton River - Cache Bridge (NW1/4 NE1/4 S1 T5N R44E) to Highway 33 bridge
US-18	Packsaddle Creek - pipeline diversion (NE1/4 S8 T5N R44E) to confluence with Teton River
US-19	Packsaddle Creek - source to pipeline diversion (NE 1/4 S8 T5N R44E)
US-20	Teton River - Teton Creek to Cache Bridge (NW1/4 NE1/4 S1 T5N R44E)
US-21	Horseshoe Creek - pipeline diversion (SE1/4 NW1/4 S27 T5N R44E) to confluence with Teton River *[Note: this is incorrect because there is no pipeline on Horseshoe Creek]*
US-22	Horseshoe Creek - source to pipeline diversion (SE1/4 NW1/4 S27 T5N R44E) *[Note: this is incorrect because there is no pipeline on Horseshoe Creek]*
US-23	Twin Creek - source to confluence with Teton River

Unit	Waters
US-24	Mahogany Creek - pipeline diversion (NE1/4 S14 T4N R44E) to confluence with Teton River
US-25	Mahogany Creek - source to pipeline diversion (NE1/4 S14 T4N R44E)
US-26	Teton River - Trail Creek to Teton Creek
US-27	Henderson Creek - source to sink
US-28	Teton River - confluence of Warm Creek and Drake Creek to Trail Creek
US-29	Patterson Creek - pump diversion (SE1/4 S 31 T4N R44E) to confluence with Teton River
US-30	Patterson Creek - source to pump diversion (SE1/4 S 31 T4N R44E)
US-31	Grove Creek - source to sink
US-32	Drake Creek - source to confluence with Warm Creek
US-33	Little Pine Creek - source to confluence with Warm Creek
US-34	Warm Creek - source to confluence with Drake Creek
US-35	Trail Creek - Trail Creek pipeline diversion (SW1/4 SE1/4 S19 T3N R46E) to confluence with Teton River
US-36	Game Creek - source to confluence with Trail Creek
US-37	Game Creek - Idaho/Wyoming border to pipeline diversion (SW1/4 SW1/4 S17 T3N R46E)
US-38	Trail Creek - Idaho/Wyoming border to Trail Creek pipeline diversion (SW1/4 SE1/4 S19 T3N R46E)
US-39	Moose Creek - Idaho/Wyoming border to confluence with Trail Creek
US-40	Fox Creek - SE1/4 SW 1/4 S28 T4N R45E to confluence with Teton River, including Spring Creek tributaries
US-41	Fox Creek - North Fox Creek Canal (NW1/4 S29 T4N R46E) to SE1/4 SW 1/4 S28 T4N R45E
US-42	Fox Creek - Idaho/Wyoming border to North Fox Creek Canal (NW1/4 S29 T4N R46E)
US-43	Foster Slough Spring Creek complex - south to Fox Creek and north to Darby Creek
US-44	Darby Creek - SW1/4 SE1/4 S10 T4N R45 to confluence with Teton River, including Spring Creek tributaries
US-45	Darby Creek - Idaho/Wyoming border to SW1/4 SE1/4 S10 T4N R45
US-46	Dick Creek Spring Creek complex - south to Darby Creek and north to Teton Creek
US-47	Teton Creek - Highway 33 bridge to confluence with Teton River, including Spring Creek tributaries
US-48	Teton Creek - Idaho/Wyoming border to Highway 33 bridge
US-49	Driggs Springs Spring Creek complex - located between Teton Creek and Woods Creek
US-50	Woods Creek - source to confluence with Teton River, including Spring Creek tributaries and Spring Creek complex north of Woods Creek to latitude 43°45' 30"
US-51	Dry Creek - Idaho/Wyoming border to sinks (SE1/4 NE1/4 S12 T5N R45E)
US-52	South Leigh Creek - SE1/4 NE1/4 S1 T5N R44E to confluence with Teton River
US-53	South Leigh Creek - Idaho/Wyoming border to SE1/4 NE1/4 S1 T5N R44E
US-54	Spring Creek - North Leigh Creek to confluence with Teton River
US-55	Spring Creek - spring to North Leigh Creek, including Spring Creek complex north of Spring Creek to latitude 43°49'55"
US-56	North Leigh Creek - Idaho/Wyoming border to confluence with Spring Creek
US-57	Badger Creek - spring (NW1/4 SW1/4 S26 T7N R44E) to confluence with Teton River
US-58	Badger Creek - diversion (NW1/4 SW1/4 S9 T6N R45E) to spring (NW1/4 SW1/4 S26 T7N R44E)
US-59	Badger Creek - confluence of North and South Forks Badger Creek to diversion (NW1/4 SW1/4 S9 T6N R45E)

Unit	Waters
US-60	South Fork Badger Creek - diversion (NE1/4 NE1/4 S12 T6N R45E) to confluence with North Fork Badger Creek
US-61	South Fork Badger Creek - Idaho/Wyoming border to diversion at NE of NE quarter of T6N R45E S12
US-62	North Fork Badger Creek - Idaho/Wyoming border to confluence with South Fork Badger Creek
US-63	Bitch Creek - Swanner Creek to confluence with Teton River
US-64	Swanner Creek - Idaho/Wyoming border to confluence with Bitch Creek
US-65	Bitch Creek - Idaho/Wyoming border to Swanner Creek

Appendix E. Water Quality Criteria

The following criteria were excerpted from *IDAPA 58.01.02 Water Quality Standards and Wastewater Treatment Requirements*.

080. VIOLATION OF WATER QUALITY STANDARDS.

01. **Discharges Which Result In Water Quality Standards Violation**. No pollutant shall be discharged from a single source or in combination with pollutants discharged from other sources in concentrations or in a manner that:

    a. Will or can be expected to result in violation of the water quality standards applicable to the receiving waterbody or downstream waters; or

    b. Will injure designated or existing beneficial uses; or

    c. Is not authorized by the appropriate authorizing agency for those discharges that require authorization.

02. **Short Term Activity Exemptio**n. The Department or the Board can authorize, with whatever conditions deemed necessary, short term activities even though such activities can result in a violation of these rules;

    a. No activity can be authorized by the provisions of Subsection 080.02 unless:

        i. The activity is essential to the protection or promotion of public interest;
        ii. No permanent or long term injury of beneficial uses is likely as a result of the activity.

    b. Activities eligible for authorization by Subsection 080.02 include, but are not limited to:

        i. Wastewater treatment facility maintenance;
        ii. Fish eradication projects;
        iii. Mosquito abatement projects;
        iv. Algae and weed control projects;
        v. Dredge and fill activities;
        vi. Maintenance of existing structures;
        vii. Limited road and trail reconstruction;
        viii. Soil stabilization measures;
        ix. Habitat enhancement structures; and
        x. Activities which result in overall enhancement or maintenance of beneficial uses.

03. **E. coli Standard Violation**. A single water sample exceeding an E. coli standard does not in itself constitute a violation of water quality standards, however, additional samples shall be taken for the purpose of comparing the results to the geometric mean criteria in Section 251 as follows:

a. Any discharger responsible for providing samples for E. coli shall take five (5) additional samples in accordance with Section 251.

b. The Department shall take five (5) additional samples in accordance with Section 251 for ambient E. coli samples unrelated to dischargers' monitoring responsibilities.

04. **Temperature Exemption**. Exceeding the temperature criteria in Section 250 will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the seven (7) day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

200. GENERAL SURFACE WATER QUALITY CRITERIA.

The following general water quality criteria apply to all surface waters of the state, in addition to the water quality criteria set forth for specifically designated waters.

01. **Hazardous Materials.** Surface waters of the state shall be free from hazardous materials in concentrations found to be of public health significance or to impair designated beneficial uses. These materials do not include suspended sediment produced as a result of nonpoint source activities.

02. **Toxic Substances.** Surface waters of the state shall be free from toxic substances in concentrations that impair designated beneficial uses. These substances do not include suspended sediment produced as a result of nonpoint source activities.

03. **Deleterious Materials.** Surface waters of the state shall be free from deleterious materials in concentrations that impair designated beneficial uses. These materials do not include suspended sediment produced as a result of nonpoint source activities.

04. **Radioactive Materials.**

a. Radioactive materials or radioactivity shall not exceed the values listed in the Code of Federal Regulations, Title 10, Chapter 1, Part 20, Appendix B, Table 2, Effluent Concentrations, Column 2.
b. Radioactive materials or radioactivity shall not exceed concentrations required to meet the standards set forth in Title 10, Chapter 1, Part 20, of the Code of Federal Regulations for maximum exposure of critical human organs in the case of foodstuffs harvested from these waters for human consumption.

05. **Floating, Suspended or Submerged Matter.** Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities.

06. **Excess Nutrients**. Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.

07. **Oxygen-Demanding Materials.** Surface waters of the state shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition.

08. **Sediment.** Sediment shall not exceed quantities specified in Sections 250 and 252 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Section 350.

250. SURFACE WATER QUALITY CRITERIA FOR AQUATIC LIFE USE DESIGNATIONS.

01. **General Criteria**. The following criteria apply to all aquatic life use designations:

a. Hydrogen Ion Concentration (pH) values within the range of six point five (6.5) to nine point five (9.5);

b. The total concentration of dissolved gas not exceeding one hundred and ten percent (110%) of saturation at atmospheric pressure at the point of sample collection;

c. Total chlorine residual.

i. One (1) hour average concentration not to exceed nineteen (19) ug/l.
ii. Four (4) day average concentration not to exceed eleven (11) ug/l.

02. **Cold Water.** Waters designated for cold water aquatic life are to exhibit the following characteristics:
a. Dissolved Oxygen Concentrations exceeding six (6) mg/l at all times. In lakes and reservoirs this standard does not apply to:
i. The bottom twenty percent (20%) of water depth in natural lakes and reservoirs where depths are thirty-five (35) meters or less.
ii. The bottom seven (7) meters of water depth in natural lakes and reservoirs where depths are greater than thirty-five (35) meters.
iii. Those waters of the hypolimnion in stratified lakes and reservoirs.

b. Water temperatures of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C.

c. Ammonia

i. One (1) hour average concentration of un-ionized ammonia (as N) is not to exceed (0.43/A/B/2) mg/l, where:

A = 1 if the water temperature (T) is greater than or equal to 20 degrees C (if T > 30 degrees C site-specific criteria should be defined), or
A = 10power(0.03(20-T)) if T is less than twenty (20) degrees C, and
B = 1 if the pH is greater than or equal to 8 (if pH > 9.0 site-specific criteria should be defined); or
B = (1 + 10power(7.4-pH))/1.25 if pH is less than 8 (if pH 6.5 site-specific criteria should be defined).

ii. Four-day average concentration of un-ionized ammonia (as N) is not to exceed (0.66/A/B/C) mg/l, where:

A = 1.4 if the water temperature (T) is greater than or equal to 15 degrees C (if T > 30 degrees C site-specific criteria should be defined), or
A = 10power(0.03(20-T)) if T is less than fifteen (15) degrees C, and
B = 1 if the pH is greater than or equal to 8 (if pH > 9.0 site-specific criteria should be defined), or
B = (1 + 10power(7.4-pH))/1.25 if pH is less than 8 (if pH 6.5 site-specific criteria should be defined), and
C = 13.5 if pH is greater than or equal to 7.7, or
C = 20(10power(7.7-pH)/(1 + 10power(7.4-pH))) if the pH is less than 7.7.

d. Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days.

e. Salmonid spawning: waters designated for salmonid spawning are to exhibit the following characteristics during the spawning period and incubation for the particular species inhabiting those waters:

i. Dissolved Oxygen.
(1) Intergravel Dissolved Oxygen.
(a) One (1) day minimum of not less than five point zero (5.0) mg/l.
(b) Seven (7) day average mean of not less than six point zero (6.0) mg/l.
(2) Water-Column Dissolved Oxygen.
(a) One (1) day minimum of not less than six point zero (6.0) mg/l or ninety percent (90%) of saturation, whichever is greater.
ii. Water temperatures of thirteen (13) degrees C or less with a maximum daily average no greater than nine (9) degrees C.

iii. Ammonia

(1) One (1) hour average concentration of un-ionized ammonia is not to exceed the criteria defined at Subsection 250.02.c.i.

(2) Four (4) day average concentration of un-ionized ammonia is not to exceed the criteria defined at Subsection 250.02.c.i.

03. **Seasonal Cold Water**. Between the summer solstice and autumn equinox, waters designated for seasonal cold water aquatic life are to exhibit the following characteristics. For the period from autumn equinox to summer solstice the cold water criteria will apply:

a. Dissolved Oxygen Concentrations exceeding six (6) mg/l at all times. In lakes and reservoirs this standard does not apply to:

i. The bottom twenty percent (20%) of water depth in natural lakes and reservoirs where depths are thirty-five (35) meters or less.

ii. The bottom seven (7) meters of water depth in natural lakes and reservoirs where depths are greater than thirty-five (35) meters.

iii. Those waters of the hypolimnion in stratified lakes and reservoirs.

b. Water temperatures of twenty-seven (27) degrees C or less as a daily maximum with a daily average of no greater than twenty-four (24) degrees C.

c. Ammonia.

i. One (1) hour average concentration of un-ionized ammonia is not to exceed the criteria defined at Subsection 250.02.c.i.

ii. Four (4) day average concentration of un-ionized ammonia is not to exceed the criteria defined at Subsection 250.02.c.ii.

04. **Warm Water.** Waters designated for warm water aquatic life are to exhibit the following characteristics:

a. Dissolved oxygen concentrations exceeding five (5) mg/l at all times. In lakes and reservoirs this standard does not apply to:

i. The bottom twenty percent (20%) of the water depth in natural lakes and reservoirs where depths are thirty-five (35) meters or less.

ii. The bottom seven (7) meters of water depth in natural lakes and reservoirs where depths are greater than thirty-five (35) meters.

iii. Those waters of the hypolimnion in stratified lakes and reservoirs.

b. Water temperatures of thirty-three (33) degrees C or less with a maximum daily average not greater than twenty-nine (29) degrees C.

c. Ammonia.

i. One (1) hour average concentration of un-ionized ammonia (as N) is not to exceed (0.43/A/B/2) mg/l, where:

A = 0.7 if the water temperature (T) is greater than or equal to 25 degrees C (if T > 30 degrees C site-specific criteria should be defined), or
A = 10power(0.03(20-T)) if T is less than 25 degrees C, and
B = 1 if the pH is greater than or equal to 8 (if pH > 9.0 site-specific criteria should be defined), or
B = (1 + 10power(7.4-pH))/1.25 if pH is less than 8 (if pH <_6.5 site-specific criteria should be defined).

ii. Four-day average concentration of un-ionized ammonia (as N) is not to exceed (0.66/A/B/C) mg/l, where:

A = 1.0 if the water temperature (T) is greater than or equal to 20 degrees C (if T > 30 degrees C site-specific criteria should be defined), or
A = 10power(0.03(20-T)) if T is less than 20 degrees C, and)
B = 1 if the pH is greater than or equal to 8 (if pH > 9.0 site-specific criteria should be defined), or
B = (1 + 10power(7.4-pH))/1.25 if pH is less than 8 (if pH <_6.5 site-specific criteria should be defined), and
C = 13.5 if pH is greater than or equal to 7.7, or
C = 20(10power(7.7-pH)/(1 + 10power(7.4-pH))) if the pH is less than 7.7.

05. **Modified**. Water quality criteria for modified aquatic life will be determined on a case-by-case basis reflecting the chemical, physical, and biological levels necessary to fully support the existing aquatic life community. These criteria, when determined, will be adopted into this rule.

251. SURFACE WATER QUALITY CRITERIA FOR RECREATION USE DESIGNATIONS.

01. **Primary Contact Recreation**. Waters designated for primary contact recreation are not to contain E. coli bacteria significant to the public health in concentrations exceeding:

a. A single sample of four hundred six (406) E. coli organisms per one hundred (100) ml; or

b. A geometric mean of one hundred twenty-six (126) E. coli organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to five (5) days over a thirty (30) day period.

02. **Secondary Contact Recreation**. Waters designated for secondary contact recreation are not to contain E. coli bacteria significant to the public health in concentrations exceeding:

a. A single sample of five hundred seventy-six (576) E. coli organisms per one hundred (100) ml; or

b. A geometric mean of one hundred twenty-six (126) E. coli organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to five (5) days over a thirty (30) day period.

252. SURFACE WATER QUALITY CRITERIA FOR WATER SUPPLY USE DESIGNATION.

01. **Domestic.** Waters designated for domestic water supplies are to exhibit the following characteristics:

a. Radioactive materials or radioactivity not to exceed concentrations specified in Idaho Department of Environmental Quality Rules, IDAPA 58.01.08, "Rules Governing Public Drinking Water Systems".

b. Small public water supplies (Surface Water).

i. The following Table identifies waters, including their watersheds above the public water supply intake (except where noted), which are designated as small public water supplies.

[Discontinuous]

ii. For those surface waters identified in Subsection 252.01.b.i. turbidity as measured at the public water intake shall not be:

(1) Increased by more than five (5) NTU above natural background, measured at a location upstream from or not influenced by any human induced nonpoint source activity, when background turbidity is fifty (50) NTU or less.
(2) Increased by more than ten percent (10%) above natural background, measured at a location upstream from or not influenced by any human induced nonpoint source activity, not to exceed twenty-five (25) NTU, when background turbidity is greater than fifty (50) NTU.

02.**Agricultural**. Water quality criteria for agricultural water supplies will generally be satisfied by the water quality criteria set forth in Section 200. Should specificity be desirable or necessary to protect a specific use, "Water Quality Criteria 1972" (Blue Book), Section V, Agricultural Uses of Water, EPA, March, 1973 will be used for determining criteria. This document is available for review at the Idaho Department of Environmental Quality, or can be obtained from EPA or the U.S. Government Printing Office.

03. **Industrial**. Water quality criteria for industrial water supplies will generally be satisfied by the general water quality criteria set forth in Section 200. Should specificity be desirable or necessary to protect a specific use, appropriate criteria will be adopted in Sections 2502 or 275 through 298.

253. SURFACE WATER QUALITY CRITERIA FOR WILDLIFE AND AESTHETICS USE DESIGNATIONS.

01. **Wildlife Habitats**. Water quality criteria for wildlife habitats will generally be satisfied by the general water quality criteria set forth in Section 200. Should specificity be desirable or necessary to protect a specific use, appropriate criteria will be adopted in Sections 2503 or 275 through 298.

02. **Aesthetics**. Water quality criteria for aesthetics will generally be satisfied by the general water quality criteria set forth in Section 200. Should specificity be desirable or necessary to protect a specific use, appropriate criteria will be adopted in Sections 2503 or 275 through 298.

Appendix F. Documents Used to Support Additions to Idaho's 1994 § 303(d) List for the Teton Subbasin.

Information to support the addition of stream segments in the Teton Subbasin to the 1994 §303(d) list promulgated by the U.S. Environmental Protection Agency (EPA) was obtained from the *1991 Upper Snake Basin Status Report* (DEQ 1991) and the *1992 Idaho Water Quality Status Report* (DEQ 1992). The portions of these reports that pertain to the Teton Subbasin are below.

Upper Snake River Basin Status Report, An Interagency Summary for the Basin Area Meeting Implementing the Antidegradation Agreement, 1991. This report (DEQ 1991) was cited as the document that supports listing the Teton River from Trail Creek to Bitch Creek. According to the report, stream segments of concern were designated after basin area meetings held in 1989, as required by Idaho's Antidegradation Agreement. Responsible agencies were assigned to monitor these segments and report the results at the 1991 basin area meetings. The report summarized these monitoring results in a table entitled, *Stream Segments of Concern, Information Revised November 1991*. The following information excerpted from the table shows that DEQ, the responsible agency for these stream segments, concluded that the beneficial uses of cold water biota and salmonid spawning were only partially supported in the Teton River from Trail Creek to Bitch Creek because of the effects of agricultural land use (Table F-1). The report does not attribute the support status of the segments to specific pollutants.

Table F-1. Excerpt from the *1991 Upper Snake River Basin Status Report* (DEQ 1991), showing stream segments of concern in the Teton Subbasin.

Waterbody Name PNRS[1] Number Boundaries	Use Support Status[2]	Purpose for Designation
Teton River 116.00 Highway 33 to Bitch Creek	Partial support of cold water biota and salmonid spawning; full support of agricultural water supply and secondary contact recreation	Ag/Grazing[3]
Teton River 117.00 Trail Creek to Highway 33	Partial support of cold water biota and salmonid spawning; full support of domestic and agricultural water supply and primary and secondary contact recreation	Ag/Grazing
Teton River 118.00 Headwaters to Trail Creek	Partial support of salmonid spawning; full support of agricultural water supply and secondary contact recreation	Ag/Grazing

[1]Pacific Northwest Rivers Study

[2]Support status was determined by Idaho DEQ through "office compilation of existing monitoring and beneficial use data≅ for Aindirect monitoring of parameters indicative of instream attainable uses." Assessments were "...based on information other than site-specific water quality data [which]...may include information on land use, modeling and complaints along with best professional judgment.

[3]Ag/Grazing is not defined in the original document, but it is presumed to indicate either cultivated agriculture or grazing.

In addition to these monitoring results, John Heimer of the Idaho Department of Fish and Game authored a report on stream segments of concern in the Upper Snake Basin that was included in the basin status report. Based on cutthroat trout catch rates, he concluded that beneficial uses in the Teton River drainage were only partially supported due to "deteriorated habitat and water quality conditions."

A status report on Idaho's State Agricultural Water Quality Program, which was also included in the basin status report, summarized the water quality-related activities of the Soil Conservation Districts, the Idaho Soil Conservation Commission, and the United States Department of Agriculture Soil Conservation Service (Table F-2). Although it is not specified in the report, the column listing beneficial uses presumably lists beneficial uses the projects are intended to protect or restore.

Table F-2. Excerpt from the *1991 Upper Snake River Basin Status Report* (DEQ 1991), showing the status of agricultural water quality projects in the Teton Subbasin.

Waterbody Name PNRS[1] Number Boundaries	Project Name Project Number[2] Status	Beneficial Use [3]	Pollutant
Teton River 115.00 Bitch Creek to Teton Dam Site	Teton River SAWQP AG-32 Implementation	Salmonid spawning	Sediment
Teton River 116.00 Highway 33 to Bitch Creek	Teton River SAWQP AG-32 Implementation	Salmonid spawning	Sediment Nutrients
Teton River 117.00 Trail Creek to Highway 33	Teton River SAWQP AG-32 Implementation	Salmonid spawning	Sediment
Teton River 117.00 Trail Creek to Highway 33	Teton River CRBS Plan	Salmonid spawning	Sediment
Trail Creek No PNRS number assigned Headwaters to Teton River	Trail Creek PL566 Completed	Not specified	Not specified

[1]Pacific Northwest Rivers Study
[2]SAWQP: State Agricultural Water Quality Program; CRBS: Cooperative River Basin Study; PL566: Small Watershed Program
[3]Though not specified in the report, it is assumed that the project is intended to protect or restore the beneficial use listed in this column.

The 1992 Idaho Water Quality Status Report. This report was the second in a series of reports produced by DEQ following amendment of the federal Clean Water Act in 1987. Sections 305(b) and 319 of the Water Quality Act, which was the name given to the amended Clean Water Act by Congress, required states to 1) complete a statewide water quality assessment, 2) develop a management program for controlling nonpoint source pollution affecting both surface water and ground water, and 3) submit a biennial report to the EPA on the status of water quality statewide (DEQ 1989). Streams in the Teton Subbasin were listed in the following appendices of *The 1992 Idaho Water Quality Status Report* (DEQ 1992): Appendix A, "Streams in Which Beneficial Uses were Supported, Partially Supported, or Threatened" (Table F-3), and Appendix D, "Streams in Which Beneficial Uses Required Further Assessment" (Table F-4).

Most of the information contained in *The 1992 Idaho Water Quality Status Report* was first reported in the *Idaho Water Quality Status Report and Nonpoint Source Assessment, 1988* (DEQ 1989). The 1988 report was based on information solicited by DEQ from "...local, state, and federal agencies, as well as interest groups, industry, Indian tribes, and citizens" (DEQ 1989). For the Teton Subbasin, Appendix A of the 1988 report which lists stream segments "...assessed as not fully supporting a beneficial use" is identical to Appendix D of the 1992 report which lists "impaired stream segments requiring further assessment" (Table F-4).

All of the stream segments identified in the *1991 Upper Snake Basin Status Report* as stream segments of concern (Table F-1), and most of the segments that appeared in *The 1992 Idaho Water Quality Status Report* (Tables F-3 and F-4), were incorporated into the 1994 §303(d) list. However, four of the stream segments listed in *The 1992 Idaho Water Quality Status Report* were not identified in the §303(d) list as water quality impaired. These segments include all of Canyon and Mahogany Creeks, and segments of the Teton River from Bitch Creek to the Teton Dam site and from the dam site to the North and South Forks. Documentation explaining the reasons these segments were not included in the 1994 §303(d) list apparently does not exist.

Table F-3. Excerpt of Appendix A of *The 1992 Idaho Water Quality Status Report* (DEQ 1992) showing the status of beneficial uses of stream segments in the Teton Subbasin.

Waterbody	PNRS[1] Number	Description	Pollutant Source	Magnitude of Pollutant	Status of Beneficial Uses
Teton River	113.00	Moody R [*sic*] to mouth	Irrigated crop production	Moderate	Drinking water and agricultural water supported; partial support of cold water biota and salmonid spawning; support of primary and secondary contact recreation threatened
Teton River	116.00	Badger Creek to Bitch Creek	None cited	Not determined	Partial support of cold water biota and salmonid spawning
Teton River	117.00	Unnamed to Leigh Creek	None cited	Not determined	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact recreation threatened
Teton River	117.00	Mahogany Creek to Unnamed	None cited	Not determined	Partial support of cold water biota and salmonid spawning
Teton River	117.00	Teton Creek to Mahogany Creek	None cited	Not determined	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact recreation threatened
Teton River	117.00	Trail Creek to Fox Creek	None cited	Not determined	Partial support of cold water biota and salmonid spawning
Moody R [*sic*]	119.00	Unnamed to mouth	Pasture land	Moderate	Drinking water and agricultural water supported; partial support of cold water biota and salmonid spawning; primary and secondary contact recreation supported
Bitch Creek	123.00	Swanner Creek to mouth	None cited	Not determined	Partial support of cold water biota and salmonid spawning
Spring Creek	127.00	Headwaters to mouth	Pasture land	Not determined	Drinking water and agricultural water supported; partial support of cold water biota; no support of salmonid spawning; support of primary and secondary contact recreation threatened
Mahogany Creek	131.00	Headwaters to mouth	None cited	Not determined	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact recreation threatened

[1]Pacific Northwest Rivers Study

Table F-4. Excerpt of Appendix D of *The 1992 Idaho Water Quality Status Report* showing impaired stream segments in the Teton Subbasin requiring further assessment.

Waterbody	PNRS[1] Number	Boundaries	Submitted by[2]	Pollutant	Major Source	Magnitude of Effect	Status of Beneficial Uses
Teton River	114.00	Teton Dam site to Teton Forks	DEQ	Siltation/sedimentation	Irrigated crop production Channelization	Moderate High	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened
Teton River	115.00	Bitch Creek to Teton Dam site	DEQ	Siltation/sedimentation	Non-irrigated crop production Channelization	Moderate High	Partial support of cold water biota and salmonid spawning
Teton River	115.00	Bitch Creek to Teton Dam site	BLM	Siltation/sedimentation Other habitat alterations	Non-irrigated crop production Dam construction	Moderate High	Not supporting cold water biota and salmonid spawning
Teton River	117.00	Trail Creek to Highway 33	IDFG	Siltation/sedimentation Thermal modification	Pastureland treatment Removal of riparian vegetation	High High	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened
Canyon Creek	121.00	Pincock Hot Spring to Teton River	DEQ	Siltation/sedimentation Flow alteration	Non-irrigated crop production Flow regulation/modification	High Moderate	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened
Canyon Creek	122.00	Headwaters to Pincock Hot Spring	IDFG	Siltation/sedimentation Flow alteration Unspecified Siltation/sedimentation Thermal modification	Pastureland treatment Dam construction Flow regulation/modification Removal of riparian vegetation Removal of riparian vegetation	Low High High Low Low	Partial support of cold water biota and salmonid spawning
Badger Creek	125.00	R45ET6NS10 to first tributary	DEQ	Siltation/sedimentation	Non-irrigated cropland	Moderate	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened
Spring Creek	127.00	Wyoming line to Teton River	IDFG	Siltation/sedimentation Flow alteration Siltation/sedimentation Thermal modification	Pastureland treatment Flow regulation/modification Removal of riparian vegetation Removal of riparian vegetation	Low High Low Low	Partial support of cold water biota; no support of salmonid spawning

Waterbody	PNRS[1] Number	Boundaries	Submitted by[2]	Pollutant	Major Source	Magnitude of Effect	Status of Beneficial Uses
Leigh Creek	128.00	Wyoming line to Teton River	DEQ	Siltation/sedimentation	Non-irrigated cropland	Moderate	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened
Packsaddle Creek	129.00	Headwaters to Teton Creek	IDFG	Siltation/sedimentation Flow alteration Thermal modification Siltation/sedimentation Thermal modification	Pastureland treatment Flow regulation/modification Flow regulation/modification Removal of riparian vegetation Removal of riparian vegetation	Low High High Low Low	Partial support of cold water biota; no support of salmonid spawning
Horseshoe Creek	130.00	Headwaters to Teton Creek	IDFG	Flow alteration	Flow regulation/modification	High	Support of cold water biota threatened; partial support of salmonid spawning
Teton Creek	132.00	Highway 33 to Teton River	DEQ	Nutrients, including nitrate Siltation/sedimentation	Pastureland treatment Streambank modification/destabilization	Moderate Moderate	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened
Darby Creek	134.00	Highway 33 to Teton River	IDFG	Siltation/sedimentation Flow alteration Flow alteration	Pastureland treatment Flow regulation/modification Removal of riparian vegetation	High High High	Support of cold water biota threatened; partial support of salmonid spawning
Fox Creek	136.00	Wyoming line to Teton River	IDFG	Siltation/sedimentation Thermal modification Flow alteration Siltation/sedimentation Thermal modification Flow alteration	Pastureland treatment Flow regulation/modification Flow regulation/modification Removal of riparian vegetation Removal of riparian vegetation Removal of riparian vegetation	High High High High High	Support of cold water biota threatened; partial support of salmonid spawning
Teton River, N & S Forks	113.00	Teton Forks to Henry s Fork	DEQ	Siltation/sedimentation Nutrients, including nitrate Siltation/sedimentation	Irrigated crop production Pastureland treatment Channelization	Moderate Moderate Moderate	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened
Moody Creek	119.00	Forest boundary to Teton River	DEQ	Nutrients, including nitrate Nutrients, including nitrate	Pastureland treatment Animal holding/management areas	Moderate Moderate	Partial support of cold water biota and salmonid spawning; support of primary and secondary contact threatened

[1]Pacific Northwest Rivers Study
[2]DEQ: Idaho Department of Health and Welfare Division of Environmental Quality; BLM: United States Department of the Interior Bureau of Land Management; IDFG: Idaho Department of Fish and Game

Appendix G. Subsurface Fine Sediment Sampling Methods (Adapted From DEQ 1999b)

Site Selection

Sample sites selected displayed characteristics of gravel size, depth, and velocity required by salmonids to spawn and were determined to be adequate spawning substrate by an experienced fisheries biologist. Samples were collected during periods of low discharge, as described in McNeil and Ahnell (1964) to minimize loss of silt in suspension within the core sampling tube. Sample sites were generally in the lower reach of streams where spawning habitat was determined to exist.

Field Methods

A 12 inch stainless steel open cylinder is worked manually as far as possible, at least 4 inches, into spawning substrate without allowing flowing water to top the core sampling tube. Samples of bottom materials were removed by hand, using a stainless steel mixing bowl, to a depth of at least 4 inches and placed into buckets. After solids were removed from the core sampling tube and placed into buckets, the remaining suspended material was discarded. It is felt that this fine material would be removed through the physical action of excavating a redd and would not be a significant factor with regard to egg to fry survival. Additionally, rinsing of sieves to process the sample results in some loss of the fraction below the smallest (0.053 mm) mesh size.

Samples were placed wet into a stack of sieves and were separated into 10 size classes by washing and shaking them through nine standard Tyler sieves having the following square mesh openings (in mm): 63, 25, 12.5, 6.3, 4.75, 2.36, 0.85, 0.212, 0.053. Silt passing the finest screen was discarded.

The volume of solids retained by each sieve was measured after the excess water drained off. The contents of each of the sieves were placed in a bucket filled with water to the level of a spigot for measurement by displacement. The water displaced by solids was collected in a plastic bucket and transferred to a 2,000 ml graduated cylinder and measured directly.   Water displaced by solids retained by the smaller diameter sieves was also collected in a plastic bucket and measured in a 250 ml graduated cylinder. Variation in sample volumes was caused by variation in porosity and core depth. All sample fractions were expressed as a percentage of the sample with and without the 63 mm fraction.

Three sediment core samples were collected at each sample site and grouped together by fractions 6.3 mm and greater and 4.75 mm to 0.53 mm. The results for a particular site are the percentage of 4.75 mm to 0.53 mm as a percent of the total sample. Standard deviation is calculated for estimates including and excluding particles 63 mm and above.

Appendix H. Selected Parameters Measured and Support Status of Aquatic Life as Determined by Beneficial Use Reconnaissance Program Protocol

Table H-1. Selected parameters measured at sites in the Teton Subbasin by the Department of Environmental Quality using the Beneficial Use Reconnaissance Project protocol.

Stream	Sample Site ID Number	Duplicate Sample Site ID	Date Sampled	Flow (cfs)	Eco[1]	Elev[2] (feet)	SO[3]	Rosgen ST[4]	MBI[5] Score	HI[6] Score	BU SS[7]	Width to Depth Ratio	Bank Stability (%)		Bank Cover (%)	
													Left Bank	Rt. Bank	Left Bank	Rt. Bank
Badger Creek	95-A006		7/24/95	56	SR	6150	3	C	4.05	101	FS	52.6	92	92	69	41
Badger Creek	95-A058		7/24/95	21	SR	6070	3	C	2.52	104	NV	29	90	90	45	50
Badger Creek	95-A059		7/24/95	15	SR	5640	3	B	1.24	83	NFS	44	91	91	68	51
Bitch Creek	95-A098	96-Z131	8/23/95	83	MR	5950	2	C	3.10	80	NA	33.3	70	84	45	61
Bitch Creek	96-Z131	95-A098	8/20/96	57	MR	5970	2	B	4.19	92	NA	43.9	96	100	17	6
Bitch Creek	95-A099	96-Z130	8/23/95	101	SR	5350	4	C	4.51	68	FS	52.6	92	64	21	10
Bitch Creek	96-Z130	95-A099	8/20/96	66	SR	5350	4	B	4.44	93	FS	84.3	100	100	40	10
Calamity Creek	97-L016		6/16/97	20	SR	6050	2	C	4.54	90	NA	7.3	92	46	2	34
Canyon Creek	95-A117		9/20/95	15	SR	5800	3	F	4.85	85	FS	17.1	80	60	85	88
Carlton Creek	97-L017		6/17/97	3	SR	5980	1	C	5.46	88	NA	14.6	78	76	64	73

Stream	Sample Site ID Number	Duplicate Sample Site ID	Date Sampled	Flow (cfs)	Eco[1]	Elev[2] (feet)	SO[3]	Rosgen ST[4]	MBI[5] Score	HI[6] Score	BU SS[7]	Width to Depth Ratio	Bank Stability (%)		Bank Cover (%)	
													Left Bank	Rt. Bank	Left Bank	Rt. Bank
Darby Creek	95-B052		7/24/95	57	SR	6460	2	A	4.84	104	FS	15.1	100	100	70	94
Darby Creek	95-B007		6/13/95	38	SR	6140	2	B	1.41	108	NFS	10.6	100	100	100	100
Darby Creek	97-L073	98-E003	7/23/97	11	SR	6020	2	C	3.26	59	NA	9.1	100	100	21	48
Darby Creek	98-E003	97-L073	8/3/98	8	SR	6000	2	C	4.67	63	NA	11	91	92	91	92
Darby Creek	95-B051		7/24/95		SR	6000	2	Site visited but not sampled because of lack of stream riffles								
Darby/Dick Creek	97-L059		7/14/97	8	SR	6120	2	B	3.28	113	NA	10.6	97	100	92	85
Drake Creek	96-Z017		6/10/96	6	SR	6440	1	B	4.94	110	FS	19.8	98	99	98	99
Dry Creek	96-Z033		6/19/96	0.3	SR	6600	1	B	1.35	95	NA	33.4	100	97	4	18
Fish Creek	97-M015		6/17/97	16	MR	6000	1	C	5.41	105	NA	11.6	72	53	74	75
Fox Creek	95-A094		8/21/95	22	SR	6560	1	B	5.07	88	FS	14.9	100	78	10	14
Fox Creek	95-B050		7/24/95	1	SR	6100	1	B	2.99	60	NFS	21.3	75	72	75	70
Game Creek	97-L058		7/14/97	73	MR	6680	2	C	4.52	115	NA	9.3	82	100	73	78

Stream	Sample Site ID Number	Duplicate Sample Site ID	Date Sampled	Flow (cfs)	Eco[1]	Elev[2] (feet)	SO[3]	Rosgen ST[4]	MBI[5] Score	HI[6] Score	BU SS[7]	Width to Depth Ratio	Bank Stability (%)		Bank Cover (%)	
													Left Bank	Rt. Bank	Left Bank	Rt. Bank
Henderson Creek	96-Z024	97-L074	6/13/96	1.8	MR	6350	1	A	3.33	83	NA	6	99	100	99	100
Henderson Creek	97-L074	96-Z024	7/23/97	1.8	MR	6360	1	A	4.69	99	NA	14.7	76	78	97	98
Hillman Creek	96-Z034		6/19/96	2	SR	6740	1	B	4.00	89	FS	5.8	96	95	96	95
Hinckley Creek	97-M013		6/16/97	4.5	MR	6200	1	B	4.88	75	NA	60	100	100	97	100
Horseshoe Creek	98-E002		8/3/98	10	MR	6460	3	C	5.65	126	NA	14.1	100	100	100	100
Horseshoe Creek	95-B004		6/7/95	3	MR	6440	3	C	2.44	78	NFS	4.2	95	90	100	100
Horseshoe Creek	95-B006	98-E001	6/13/95	37	SR	6015	3	C	2.30	70	NFS	5.3	30	60	100	95
Horseshoe Creek	98-E001	95-B006	7/7/98	7	SR	6015	3	C	3.77	108	NA	7.8	88	82	96	94
Horseshoe Creek North Fork	97-L057		7/14/97	1.6	MR	6740	1	A	5.37	115	NA	10.9	77	81	76	75
Little Pine Creek	96-Z025		6/13/96	2.6	SR	6280	3	B	4.68	101	FS	9.1	100	100	100	98
Mahogany Creek	96-Z121		8/14/96	9	MR	6340	2	F	5.40	95	FS	19.9	100	100	84	95
Marlow Creek	97-M012		6/16/97	7.5	MR	6800	2	A	5.39	83	NA	21.4	75	90	66	90

Stream	Sample Site ID Number	Duplicate Sample Site ID	Date Sampled	Flow (cfs)	Eco[1]	Elev[2] (feet)	SO[3]	Rosgen ST[4]	MBI[5] Score	HI[6] Score	BU SS[7]	Width to Depth Ratio	Bank Stability (%) Left Bank	Bank Stability (%) Rt. Bank	Bank Cover (%) Left Bank	Bank Cover (%) Rt. Bank
Middle Twin Creek	97-L065		7/16/97	0.6	MR	6175	1	A	4.49	99	NA	2.3	88	91	90	89
Mike Harris Creek	96-Z029		6/18/96	18	SR	6730	2	C	4.37	93	FS	5.8	95	97	94	97
Milk Creek	96-Z031		6/18/96	2.3	SR	7410	1	B	4.88	92	FS	13.3	93	87	88	89
Milk Creek	98-E004		8/4/98	0.7	SR	6660	1	B	3.21	73	NA	43.8	80	67	80	75
Moody Creek	95-B083		8/22/95		SR	5960	2	Site visited but not sampled because of beaver complex (no stream riffles)								
Moody Creek	95-B082		8/21/95	4	SR	5240	3	C	3.07	83	NV	32.3	85	88	50	73
Moody Creek	95-B084		8/22/95		SR	4922	3	Site visited but not sampled because of lack of stream riffles								
Moose Creek	97-M077		7/24/97	95	MR	6750	2	B	5.11	104	NA	21.7	100	100	100	100
Morris Creek	97-L066		7/16/97	0.1	MR	5880	1	A	4.60	113	NA	16.5	100	92	97	95
Murphy Creek	96-Z027		6/17/96	1.4	SR	6200	1	B	4.84	109	FS	10.7	96	97	96	98
North Leigh Creek	95-B058		7/27/95	57	SR	6440	1	B	1.16	103	NFS	27.8	83	92	66	79
North Leigh Creek	95-B057		7/26/95	35	SR	6140	1	C	1.89	102	NFS	23.8	96	96	86	81

Stream	Sample Site ID Number	Duplicate Sample Site ID	Date Sampled	Flow (cfs)	Eco[1]	Elev[2] (feet)	SO[3]	Rosgen ST[4]	MBI[5] Score	HI[6] Score	BU SS[7]	Width to Depth Ratio	Bank Stability (%) Left Bank	Bank Stability (%) Rt. Bank	Bank Cover (%) Left Bank	Bank Cover (%) Rt. Bank
North Moody Creek	97-L015		6/16/97	37	MR	6560	2	B	5.39	80	NA	22.6	71	98	69	87
North Twin Creek	96-Z023		6/12/96	4	SR	6760	1	B	5.28	107	FS	6.7	100	100	100	100
Packsaddle Creek	95-B003		6/7/95	24	SR	6929	2	B	3.91	111	FS	5.3	100	100	100	100
Packsaddle Creek	95-B005		6/8/95	57	SR	6140	2	F	2.44	106	NFS	13.4	100	100	90	995
Packsaddle Creek North Fork	96-Z032		6/18/96	7	SR	6540	1	A	5.11	112	FS	10.2	100	99	90	97
Patterson Creek	96-Z018		6/10/96	13	SR	6240	1	B	3.52	104	FS	9.2	95	98	95	98
Pole Canyon Creek	96-Z028		6/17/96	7	SR	6750	1	A	3.64	91	FS	13.5	100	100	94	78
Ruby Creek	97-M011		6/16/97	29	MR	6800	1	A	4.85	113	NA	4.1	87	87	100	100
Sheep Creek	97-L013		6/16/97	2	MR	6555	1	C	4.21	106	NA	22.9	100	95	100	95
South Leigh Creek	95-B054		7/25/95	66	SR	6480	2	B	2.99	96	NV	19.5	100	100	92	70
South Leigh Creek	98-E005		8/4/98	9	SR	6220	2	C	4.44	100	NA	49.3	92	56	92	66
South Leigh Creek	95-B056		7/26/95	45	SR	5980	2	C	2.14	78	NFS	37.7	100	100	67	86

Stream	Sample Site ID Number	Duplicate Sample Site ID	Date Sampled	Flow (cfs)	Eco[1]	Elev[2] (feet)	SO[3]	Rosgen ST[4]	MBI[5] Score	HI[6] Score	BU SS[7]	Width to Depth Ratio	Bank Stability (%)		Bank Cover (%)	
													Left Bank	Rt. Bank	Left Bank	Rt. Bank
South Moody Creek	97-L014		6/16/97	4	MR	6825	1	B	3.92	102	NA	5.6	100	100	88	91
South Moody Creek	97-M016		6/17/97	13	MR	6300	2	B	3.94	91	NA	12.3	56	67	62	74
South Twin Creek	97-L064		7/16/97	0.4	MR	6110	1	B	4.53	66	NA	14.7	71	75	46	71
Spring Creek	95-B024		6/27/95	4	SR	6200	2	F	1.26	86	NFS	6.7	0	0	95	80
Spring Creek	97-M152		9/24/97	0.4	SR	6170	1	E	1.33	50	NA	31.4	100	100	100	100
Spring Creek	95-B055		7/25/95	53	SR	5980	2	F	2.91	94	NV	19.6	100	100	100	100
State Creek	97-M014		6/17/97	2.5	MR	5900	2	B	4.5	112	NA	14.5	100	86	100	100
Sweet Hollow Creek	96-Z030		6/18/96	1.5	SR	6360	1	B	2.72	95	NA	6.9	100	100	100	100
Teton Creek	97-L076		7/24/97	63	MR	6560	1	B	5.45	91	FS	23.8	97	95	75	67
Teton Creek	95-A095		8/22/95		SR	6330	1	Site visited but not sampled - dry channel								
Teton Creek	95-A112		9/7/95	7	SR	6080	1	C	3.61	95	FS	47.7	89	100	70	24
Teton Creek	95-B053		7/25/95		SR	6000	2	Site visited but not sampled - slow, deep water								
North Fork Teton	95-A108		9/6/95		SR	4940		Site visited but not sampled - deep water								

Stream	Sample Site ID Number	Duplicate Sample Site ID	Date Sampled	Flow (cfs)	Eco[1]	Elev[2] (feet)	SO[3]	Rosgen ST[4]	MBI[5] Score	HI[6] Score	BU SS[7]	Width to Depth Ratio	Bank Stability (%) Left Bank	Bank Stability (%) Rt. Bank	Bank Cover (%) Left Bank	Bank Cover (%) Rt. Bank
North Fork Teton River	95-A111		9/6/95		SR	4850		Site visited but not sampled - deep water								
South Fork Teton River	95-A100		8/24/95	97	SR	4930		C	4.11	81	FS	33.8	94	100	17	38
South Fork Teton River	95-A113		9/7/95		SR	4825		Site visited but not sampled - deep water								
Trail Creek	98-E006		8/4/98	36	MR	6520	2	B	5.13	97	NA	17.3	100	95	100	100
Warm Creek Teton County	97-L063		7/16/97	19	MR	6140	1	E	2.61	97	NA	14.8	100	100	100	100
Warm Creek Madison County	97-L018		6/17/97	3.6	SR	5890	2	D	3.36	69	NA	23.5	100	100	71	18
Woods Creek	97-L071		7/22/97	0.6	SR	5950	2	E	2.51	113	NA	6.2	100	100	100	96
Wright Creek	97-L019		6/17/97	7	SR	5835	1	G	4.68	101	NA	3.9	51	71	55	71

[1]Ecoregion: Snake River Basin/High Desert (SR) or Middle Rockies (MR)
[2]Elevation
[3]Stream order
[4]Rosgen stream type
[5]Macroinvertebrate Biotic Index (MBI)
[6]Habitat Index (HI)
[7]Beneficial use support status: full support (FS), not full support (NFS), needs verification (NV), not assessed (NA)

Table H-2 The support status of cold water aquatic life as determined for stream sites sampled using the Beneficial Use Reconnaissance Program protocol, and the results of corresponding measurements of substrate embeddedness and percentage of fine sediment at sampled sites. Sampling sites located in §303(d)-listed segments are shown in *italics*.

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4] 0-25%	25-50%	50-75%	>75%	Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					Optimal: Score1 6-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
Badger Creek	95-A006	Full Support	4.05	49	NA[6]	NA	NA	NA	25	25	0
Badger Creek	*95-A058*	*Not Full Support*	*2.52*	*14*	*17*				*38*	*20*	*1*
Badger Creek	*95-A059*	*Not Full Support*	*1.24*	*1*				*0*	*38*	*20*	*6*
Bitch Creek	95-A098	Full Support	3.10	21		12			24	16	1
Bitch Creek	96-Z131	Full Support	4.19	45	17				7	6	0
Bitch Creek	95-A099	Full Support	4.51	33			10		19	12	2
Bitch Creek	96-Z130	Full Support	4.44	62	16				11	11	4
Calamity Creek	97-L016	Not Assessed	4.54	65	19				61 (44)	45 (29)	40 (28)
Canyon Creek	95-A117	Full Support	4.85	64			7		27	22	14

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score1 6-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
Carlton Creek	97-L017	Not Assessed	5.46	83	17				51 (34)	26 (10)	11 (1)
Darby Creek	95-B052	Full Support	4.84	92	17				24	23	18
Darby Creek	*95-B007*	*Not Full Support*	*1.41*	*0*		*15*			*44*	*44*	*44*
Darby Creek	*97-L073*	*Not Assessed*	*3.26*	*26*				*1*	*86 (78)*	*84 (78)*	*84 (78)*
Darby Creek	*98-E003*	*Full Support*	*4.45*	*33*				*0*	*96 (94)*	*96 (94)*	*96 (94)*
Darby Creek	*95-B051*	*Not Sampled - Wetland*									
Darby/Dick Creek	*97-L059*	*Not Assessed*	*3.28*	*26*			*10*		*34 (17)*	*31 (14)*	*31 (14)*
Drake Creek	96-Z017	Full Support	4.94	89	18				58	54	46
Dry Creek	96-Z033	Not Full Support	1.35	6	17				36	30	26
Fish Creek	97-M015	Not Assessed	5.41	87		15			31 (11)	26 (8)	24 (6)

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score [2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score16-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
Fox Creek	*95-A094*	*Full Support*	*5.07*	*92*		*12*			*31*	*21*	*11*
Fox Creek	*95-B050*	*Needs Verification*	*2.99*	*38*		*11*			*61*	*61*	*56*
Game Creek	97-L058	Not Assessed	4.52	42	19				26 (12)	23 (11)	19 (4)
Henderson Creek	96-Z024	Not Assessed	3.33	72		11			88	84	84
Henderson Creek	97-L074	Not Assessed	4.69	57	16				79 (34)	68 (10)	68 (10)
Hillman Creek	96-Z034	Full Support	4.00	68				4	95	90	77
Hinckley Creek	97-M013	Not Assessed	4.88	48			8		70 (67)	64 (59)	60 (52)
Horseshoe Creek	*95-B004*	*Not Full Support*	*2.44*	*16*			*6*		*84*	*81*	*73*
Horseshoe Creek	*95-B006*	*Not Full Support*	*2.30*	*13*			*7*		*81*	*79*	*69*

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score 16-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
Horseshoe Creek	98-E001	Not Assessed	3.77	19		11			37 (28)	26 (17)	19 (9)
North Fork Horseshoe Creek	98-E002	Not Assessed	5.65	72	18				24 (11)	22 (9)	15 (3)
North Fork Horseshoe Creek	97-L057	Not Assessed	5.37	47	19				62 (30)	45 (12)	44 (11)
Little Pine Creek	96-Z025	Full Support	4.68	80		13			54	47	42
Mahogany Creek	96-Z121	Full Support	5.40	75		13			52	49	48
Marlow Creek	97-M012	Not Assessed	5.39	84		13			49 (29)	43 (24)	36 (19)
Middle Twin Creek	97-L065	Not Assessed	4.49	47				4	97 (92)	84 (62)	71 (34)
Mike Harris Creek	96-Z029	Full Support	4.37	78				5	77	74	65

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score 16-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
Milk Creek	96-Z031	Not Assessed	4.88	80		15			58	54	52
Milk Creek	98-E004	Not Assessed	3.21	10				4	45 (20)	36 (6)	29 (1)
Moody Creek	*95-B082*	*Needs Verification*	*3.07*	*22*		*14*			*33*	*31*	*20*
Moody Creek	95-B084	Not Sampled - No Riffles – Not Moody Creek - Correct identification is Woodmansee Johnson Canal									
Moose Creek	97-M077	Not Assessed	5.11	88	18				19 (2)	19 (2)	16 (0)
Morris Creek	97-L066	Not Assessed	4.60	49	17				58 (11)	51 (6)	49 (3)
Murphy Creek	96-Z027	Full Support	4.84	69	16				55	49	44
North Leigh Creek	95-B058	Not Full Support	1.16	3	17				24	22	14
North Leigh Creek	95-B057	Not Full Support	1.89	11		11			28	26	23
North Moody Creek	95-B083	Not Sampled – Beaver Complex									

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score16-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
North Moody Creek	97-L015	Not Assessed	5.39	71	17				44 (21)	41 (19)	38 (14)
North Twin Creek	96-Z023	Not Assessed	5.28	80		15			67	60	59
Packsaddle Creek	*95-B003*	*Full Support*	*3.91*	*45*		*16*			*49*	*48*	*46*
Packsaddle Creek	*95-B005*	*Not Full Support*	*2.44*	*20*		*16*			*43*	*42*	*38*
North Fork Packsaddle Creek	96-Z032	Full Support	5.11	89	17				34	27	25
Patterson Creek	96-Z018	Full Support	3.52	60	16				54	52	48
Pole Canyon Cr	96-Z028	Full Support	3.64	76	17				42	39	36
Ruby Creek	97-M011	Not Assessed	4.85	66	19				50 (3)	49 (1)	49 (1)
Sheep Creek	97-L013	Not Assessed	4.21	67	19				80 (25)	67 (11)	64 (8)

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score 16-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
South Leigh Creek	***95-B054***	***Needs Verification***	***2.99***	***20***		***11***			***20***	***16***	***8***
South Leigh Creek	***98-E005***	***Not Assessed***	***4.44***	***31***	***16***				***6 (4)***	***6 (4)***	***5 (4)***
South Leigh Creek	***95-B056***	***Not Full Support***	***2.14***	***6***		***13***			***18***	***14***	***10***
South Moody Creek	97-L014	Not Assessed	3.92	46	16				76 (42)	72 (26)	72 (26)
South Moody Creek	97-M016	Not Assessed	3.94	92		14			41 (5)	37 (5)	28 (2)
South Twin Creek	97-L064	Not Assessed	4.53	52				1	99 (98)	95 (89)	86 (66)
Spring Creek	*95-B024*	*Not Full Support*	*1.26*	*5*			*10*		*75*	*69*	*64*
Spring Creek	*97-M152*	*Not Assessed*	*1.33*	*0.3*	*NA*	*NA*	*NA*	*NA*	*100*	*100 (100)*	*100 (100)*
Spring Creek	*95-B055*	*Needs Verification*	*2.91*	*30*		*14*			*22*	*19*	*16*

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score 16-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
State Creek	97-M014	Not Assessed	4.5	45	16				43 (0)	43 (0)	43 (0)
Sweet Hollow Creek	96-Z030	Needs Verification	2.72	15		15			72	69	67
Teton Creek	97-L076	Full Support	5.45	83	16				27 (16)	22 (13)	9 (1)
Teton Creek	95-A095	Not Sampled - Stream Channel Dry									
Teton Creek	95-A112	Full Support	3.61	31		12			13	7	6
Teton Creek	95-B053	Not Sampled - Slow, Deep Water/No Riffles									
North Fork Teton River	*95-A108*	*Not Sampled - Deep Water*									
North Fork Teton River	*95-A111*	*Not Sampled - Deep Water*									
South Fork Teton River	95-A100	Full Support	4.11	55	NA	NA	NA	NA	18	12	6
South Fork Teton River	95-A113	Not Sampled - Deep Water									
Trail Creek	98-E006	Not Assessed	5.13	74			8		42 (28)	43 (28)	38 (21)

Stream	Sample Site ID Number	Cold Water Aquatic Life Support Status as Assessed for the 1998 §303(d) List[1]	MBI Score[2]	% EPT[3]	Embeddedness[4]				Percentage of Bankfull Substrate Consisting of Fine Sediment Particles:[5]		
					0-25%	25-50%	50-75%	>75%			
					Optimal: Score16-20	Sub-optimal: Score 11-15	Marginal: Score 6-10	Poor: Score 0-5	< 6 mm Diameter	< 2.5 mm Diameter	< 1 mm Diameter
Warm Creek, Teton County	97-L063	Not Assessed	2.61	14	17				61 (54)	54 (45)	48 (39)
Warm Creek, Madison County	97-L018	Not Assessed	3.36	45	17				79 (75)	48 (41)	31 (24)
Woods Creek	97-L071	Not Assessed	2.51	8	16				81 (68)	71 (51)	65 (40)
Wright Creek	97-L019	Not Assessed	4.68	77			9		59 (33)	41 (12)	41 (11)

[1]BURP data collected in 1995 and 1996 were assessed according to the process described in *1998 §303(d) List* (DEQ 1998b) to determine beneficial use support status; data collected in 1997 and 1998 have not yet been assessed.
[2]Macroinvertebrate biotic index score. An MBI 3.5 indicates full support of cold water aquatic life; an MBI 2.5 indicates cold water aquatic life is not supported (i.e., not full support); an MBI between 2.5 and 3.5 indicates that additional data is required to verify support status (i.e., needs verification).
[3]The percentage of macroinvertebrates belonging to the orders Ephemeroptrera, Plecoptera, and Trichoptera (EPT), which are important food sources for fish. An inverse correlation between % EPT and percentage of fines less than 6 mm has been demonstrated for all BURP sites throughout the state (Mebane 2000).
[4]Embeddedness is a qualitative estimate of the degree to which larger substrate particles in stream riffles are surrounded by fine substrate particles less than 6.35 mm in diameter. Embeddedness is estimated by assigning a score of 0 to 20, with 0 indicating maximum embeddedness and 20 indicating minimum embeddedness.
[5]Calculated using modified Wolman pebble count data. Prior to 1997, pebble counts were conducted across the bankfull width of the stream channel and included particles in the streambanks. Beginning in 1997, pebble counts were conducted 1) across the bankfull width and 2) within the wetted width of the channel. Numbers not enclosed in parentheses are for counts conducted across the bankfull width of the stream; numbers enclosed in parentheses are for counts conducted across the wetted width of the stream channel.
[6]NA indicates there are no numbers in any of the four embededness columns. Empty cells in these columns indicate there is at least one number in one of the four columns.

Appendix I. Analytical Results of Water Quality Samples Collected by DEQ in June, July, and August 2000.

Stream	Site	Date	Discharge (cfs)	pH (su)	Stream Temperature (degrees C)	Specific Conductance (microsiemens/cm)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Total Kjeldahl Nitrogen (mg/L as N)	Nitrate (mg/L as N)
Badger Creek	26	6/14/00	NS	NS	NS	NS	NS	NS	NS	NS
(at Rammel Road)		6/27/00	44.1	7.8	12.1	20	1.6	0.9	0.1	0
		7/26/00	4.2	8	17.3	65	1.1	0.8	0.1	0.02
		8/22/00	0.0							
Darby Creek	20	6/13/00	41.9	8.6	6.7	180	3.1	8.4	0.2	0.09
(west of Highway 33)		6/26/00	2.9	7.8	11.2	170	2	1.3	0	0.03
		7/25/00	0.3	7.6	10	315	0.3	0.9	0	0
		8/21/00	0.0							
Fox Creek	4	6/14/00		8.3	5.2	150	2.8	2	0.1	0.11
(on forest)		6/26/00		8.3	7.1	125	1.8	1.4	0	0.07
		7/25/00		8.4	10.5	150	0	0.4	0.2	0.08
		8/21/00	12.3	8.5	10.4	140	0.8	0.9	0.1	0.09
Fox Creek	3	6/14/00	57.3	8.1	7.7	260	5.1	3.1	0.2	1.07
(IDFG access)		6/26/00	68.8	8.5	15	295	3.3	1	0.2	0.87
		7/25/00	51.9	8.7	18.8	200	4.7	1		
		8/21/00	56.2	8.2	9.6	330	0.4	1.2	0.2	1.09
Horseshoe Creek	13	6/13/00	13.9	8.4	10.3	310	6.1	4.4	0	0.02
(below forest boundary)		6/26/00	8.3	8.5	16.6	290	5.1	3.5	0.1	0
		7/26/00	5.5	8.3	14.5	300	7	5.7	0.2	0
		8/22/00	3.4	8.2	12.8	330	3.5	3.8	0	0
Moody Creek	22	6/15/00		8.5	17.2	140	5.3	2.7	0.2	0.08
(at Woods Crossing)		6/28/00		8.5	20.2	130	8.3	2	0.2	0.03
		7/27/00		8	18.7	180	14.4	2.1	0.2	0.06
		8/24/00		8.1	18.2	230	26.7	4.7	0.2	0.02
Moody Creek	23	6/15/00	2.0	8.4	18.9	135	4.9	3.4	0.2	0
(at Elbow of Moody		6/28/00		8.1		150	12.7	9.8	0.3	0
Creek)		7/27/00	1.2	8.4	23.5	230	13	11	0.2	0.13
		8/24/00	1.2	8.4	19.9	260	0.4	3.7	0.2	0.08
Moody Creek	24	6/15/00	19.7	8.4	16	90	15.2	7.8	0.2	0

Stream	Site	Date	Discharge (cfs)	pH (su)	Stream Temperature (degrees C)	Specific Conductance (microsiemens/cm)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Total Kjeldahl Nitrogen (mg/L as N)	Nitrate (mg/L as N)
(500 m below Enterprise		6/28/00	3.4	8.2	18.2	140	6.7	4.6	0.2	0.03
Canal)		7/27/00	2.9	8.2	21	150	4	4.4	0.2	0.23
		8/24/00	8.9	8.3	22.2	180	7.4	4	0.2	0.29
Moody Creek	25	6/15/00		8.6		150	16.4	6.9	0.2	0.11
		6/28/00		8.4		175	13	4.9	0.4	0.22
		7/27/00		8.4		165	7.8	4	0.4	0.23
		8/24/00		8.4		190	0	5	0.2	0.19
Moose Creek	1	6/13/00		8.4	5.7	220	8.9	4	0	0.16
(on forest)		6/26/00		8.4	7.2	170	3.6	1.4	0	0.14
		7/25/00		8.4	9.7	150	1.6	1.4	0.1	0.15
		8/21/00	47.7	8.5	12.6	170	1.6	1.2	0	0.11
North Fork Teton River	12	6/15/00		8.5		200	5	7.9	0.2	0.18
(north of city of Teton)		6/27/00		8.8		130		2.3	0.2	0.17
		7/27/00		8.4		160	2.2	1.9	0.3	0.22
		8/24/00		8.5		210	0.28	3.3	0.2	0.29
North Leigh Creek	19	6/14/00	49.7	8.1	7.3	115	4.5	2.2	0.2	0.04
(near confluence with		6/27/00	20.2	8	11.1	110	2.1	1.4	0.1	0
Spring Creek)		7/26/00	0.0							
		8/22/00	0.0							
North Fork Teton River	11	6/15/00		8.3	13.8	165	9.5	4.3	0.2	0.14
(near Henry's Fork)		6/28/00		8.8	22.2	160	1.3	1.3	0.2	0.3
		7/27/00		8.6		190	3.8	2.3	0.2	0.25
		8/24/00		9		250	9	4.7	0.2	0.06
North Moody Creek	21	6/15/00	6.6	8.4	18.2	60	8.8	5.4	0.2	0
(on forest)		6/28/00	4.6	8.3	16.4	60	3.3	4	0.2	0
		7/27/00	2.1	8.4	19.2	85	4.1	1.9	0.2	0.04
		8/24/00	1.2	8.4	19.5	100	8.4	2	0.3	0
Packsaddle Creek	15	6/13/00	2.9	8.2	11.5	100	2.9	2.7	0.1	0.03
(below forest boundary)		6/26/00		8.1	14.4	130	1.2	3.5	0.1	0.04
		6/26/00	0.2	7.8	12.7	140	1.1	0.6	0.1	0.06
		8/22/00	0.5	7.8	12.7	120	0	0.6	0	0.04
Packsaddle Creek	14	6/13/00	1.9	8.5	14.9	110	2.3	5.2	0.2	4.16

Stream	Site	Date	Discharge (cfs)	pH (su)	Stream Temperature (degrees C)	Specific Conductance (microsiemens/cm)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Total Kjeldahl Nitrogen (mg/L as N)	Nitrate (mg/L as N)
(Poleline Road)		6/26/00	0.0							
		7/26/00	0.0							
		8/22/00	0.0							
South Fork Teton River	9	6/14/00		8.8	16	200	4.5	3.1	0.2	0.2
(USGS gage in Rexburg)		6/28/00	0.0	8.6	19.3	190	3.4	2.2	0.2	0.09
		7/27/00								
		8/24/00	0.0							
South Fork Teton River	10	6/14/00		8.9	16.8	175	2.8	3	0.3	0.21
(southwest of golf course)		6/28/00		9	23.8	195	1.5	1.8	0.3	0.06
		7/27/00		8		440	3.5	2	0.9	0.18
		8/24/00		7.9		420	2.5	1.6	0.4	3.27
South Leigh Creek	17	6/14/00	94.3	8.2	5.5	80	16.4	1.2	0.2	0.07
(at state line)		6/27/00	61.1	8.2	9.5	60	0.8	0.9	0.1	0
		7/26/00	10.9	8.4	13.9	180	1.2		0.1	0
		8/22/00	7.8	8.5	13.1	200	0	0.5	0.1	0.03
South Leigh Creek	16	6/14/00	21.7	8.2	10.1	165	0.8	0.9	0.2	0.04
(west of Highway 33)		6/27/00	2.6	7.9	16	180	0.5	0.5	0	0
		7/26/00	0.0							
		8/22/00	0.0							
Spring Creek	18	6/14/00		9.9	12	195	12.1	5.4	0.3	0.17
(west of Highway 33)		6/27/00	15.9	8.2	14.2	190	5	2.5	0.2	0.16
		7/26/00	2.5	8.6	18.4	270	3.2	2.9	0.3	0.03
		8/22/00	1.8	8.7	18.8	250	1.7	1.7	0.2	0
Teton Creek	27	6/14/00	NS	NS	NS	NS	NS	NS	NS	NS
(near confluence with		6/26/00		8.5	14.7	185	3.1	3.1	0.1	0.92
Teton River)		7/25/00	54.6	8.7	18.8	260	1.8	1.3	0.3	1.64
		8/21/00	39.1	8.4	10.9	260	1.8	1.6	0.2	2.13
Teton River	6	6/14/00		8.3	6.9	265	15.5	5.4	0.2	0.41
(Cedron Bridge)		6/26/00		8.6	14.6	250	2.4	2.9	0.2	0.55
		7/25/00		8.6	17.7	300	4	2.2	0.2	0.93
		8/21/00		8.5	17.5	320	3	1.8	0.3	0.98
Teton River	5	6/13/00		8.3	9.8	285	12.6	5.2	0.2	0.41
(Bates Bridge)		6/26/00		8.8	18.3	250	1.7	1.5	0.2	0.46

Stream	Site	Date	Discharge (cfs)	pH (su)	Stream Temperature (degrees C)	Specific Conductance (microsiemens/cm)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Total Kjeldahl Nitrogen (mg/L as N)	Nitrate (mg/L as N)
		7/25/00		8.8	22.5	270	1.7	1.8	0.3	0.61
		8/22/00		8.3	15.6	240	2.8	2.9	0.3	0.67
Teton River	7	6/13/00		8.2	12.3	235	24.6	7.1	0.3	0.51
(Cache Bridge)				8.4		265	6.1	2.6	0.2	0.53
				8.4	18.5	290	2.3	1.2	0.2	0.68
				8.4	16.3	290	2.9	3.6	0.2	0.75
Teton River	8	6/14/00		10.2	16.4	200	9.7	2.6	0.3	0.21
(Harrop's Bridge)		6/27/00		8.5	17.8	250	2.7	1.2	0.3	0.18
		7/27/00		8.3	19	310	2.1	2.1	0.4	0.47
		8/22/00		8.5	17.6	270	1.3	1.3	0.3	0.59
Trail Creek	2	6/13/00	45.5	8.3	6.6	300	7.2	3.2	0	0.13
(on forest)		6/26/00	36.0	8.5	7.8	240	4	2.2	0	0.11
		7/25/00	18.8	8.6	12	180	2.5	1.5	0	0.08
		8/21/00	18.9	8.6	16.2	240	5.4	2.1	0.2	0.05
Duplicate										
(collected at Horseshoe Creek site 13)	28	6/13/00					6.5		0	0.02
		6/26/00					5.9		0.1	0
		7/26/00					6.8		0.1	0
		8/22/00					3.9		0.1	0
Field Blanks										
(de-ionized water)	29	6/15/00					0		0.1	0
		6/28/00					0		0	0
		7/25/00					0.3		0.1	0
		8/22/00					0.3		0.1	0

Appendix J. Selected Water Quality Parameters Measured at USGS gage 13055000, *Teton River near St. Anthony*.

Water Year	Month	Date Sampled	Flow (cfs)	Dissolved $NO_2 + NO_3$ (mg/L)	Total P (mg/L)	Suspended Sediment (mg/L)	Suspended Sediment Discharge (Tons/day)	Turbidity (NTU)
October 1977 – September 1978	Oct	19	291	8.20	0.87			
October 1979 – September 1980	Jan	17	480	0.63	0.03			
	May	28	1790	0.17	0.12			
October 1980 – September 1981	Oct	1	526	0.24	0.04			
	July	9	1020	0.08	0.03			
October 1989 – September 1990	Nov	17	494	0.60	<0.01	2		
	Jan	22	352	0.80	0.01			
	March	12	485	0.70	0.03	13	18	
	May	28	1160	0.10	0.01	6	19	
	July	30	862	0.10	0.02			
	Sept	24	633	0.20	<0.01	2	4.1	
October 1992 – September 1993	Nov	16	387	0.70	<0.01	3	3.1	0.7
	Jan	28	383	0.87	<0.01			
	March	16	356	0.65	0.03	6	5.8	4.8
	April	14	469	0.47	0.01	8	10	
		28	510	0.36	0.02	8	11	
	May	5	1200	0.30	0.02	16	52	
		12	1150	0.31	0.02	14	43	4.5
		19	3110	0.19	0.04	29	244	
		25	3650	0.18	0.02	31	306	
	June	2	3470	0.14	<0.01	23	215	
		9	2580	0.22	0.01	18	125	
		16	2450	0.18	<0.01	13	86	
		23	2870	0.14	0.03	25	194	
		30	2040	0.19	0.01	10	55	
	July	7	1890	0.25	0.04	20	102	
		14	1410	0.19	0.02	13	49	
		21	1230	0.26	<0.01	15	50	
		28	1760	0.30	0.03	6	29	
	Aug	4	1060	0.26	<0.01	4	11	
		11	1010	0.30	0.01	5	14	
		18	962	0.34	0.05	10	26	
		25	982	0.35	0.02	4	11	
	Sept	15	748	0.11	0.02	3	6.1	0.3
October 1993 – September 1994	Oct	20	576	0.61	<0.01	4	6.2	
	Nov	17	682	0.66	<0.01	5	9.2	
	Dec	15	664	0.71	<0.01	2	3.6	
	Jan	12	433	0.95	<0.01	4	4.7	
	Feb	16	359	1.00	0.01	38	37	
	March	16	574	0.64	0.03	20	31	
	April	13	495	0.60	0.01	11	15	
	May	2	774	0.32	0.03	8	17	
	June	24	1270	0.26	0.04	8	27	
		13	979	0.16	0.03	11	29	

Water Year	Month	Date Sampled	Flow (cfs)	Dissolved $NO_2 + NO_3$ (mg/L)	Total P (mg/L)	Suspended Sediment (mg/L)	Suspended Sediment Discharge (Tons/day)	Turbidity (NTU)
October 1993 – September 1994	June	29	796	0.09	<0.01	7	15	
	July	20	632	0.11	0.02	5	8.5	
	Aug	17	618	0.14	<0.01	9	15	
	Sept	7	668	0.17	<0.01	6	11	
October 1994 – September 1995	Oct	6	763	0.44	0.01	7	14	
	Nov	2	389	0.55	<0.01	3	3.2	
	Dec	6	361	0.70	<0.01	38	37	
	Jan	10	361	0.87	0.03	6	5.8	
	Feb	15	413	0.73	<0.01	6	6.7	
	March	15	710	0.50	0.02	14	27	
	April	11	715	0.64	<0.01	10	19	
	May	9	1340	0.33	0.04	15	54	
		23	2710	0.24	0.05	27	198	
	June	13	3130	0.24	0.03	36	304	
	July	5	3010	0.18	0.02	12	98	
October 1995 – September 1996	April	17	763	0.48	0.04	17	35	4.5
	May	28	2910	0.27	0.03	28	220	6.4
	June	28	2680	0.18	<0.01	10	72	2
	July	23	1120	0.32	<0.01	5	15	1.5
	Aug	23	772	0.41	<0.01	4	8.3	0.8
	Sept	25	814	0.57	<0.01	1	2.2	0.4

Appendix K. Concentrations of Nitrogen, Total Phosphorus, and Suspended Solids Collected from the Mouth of Bitch Creek and Where Bitch Creek Crosses the National Forest Boundary

Table K-1. Concentrations of NO_2 + NO_3 and Kjeldahl nitrogen in samples collected from Bitch Creek at the mouth of Bitch Creek and the National Forest boundary.

	NO_2 + NO_3 (mg/L as N)								Kjeldahl Nitrogen (mg/L as N)							
	1995		1996		1997		1998		1995		1996		1997		1998	
Date	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth
2-12							0.11	0.82							0.27	0.35
2-18					0.11	0.89							0.10	0.16		
2-19							0.09	0.92							0.22	0.64
3-1							0.08	0.93							0.12	0.22
3-7							0.10	0.88							0.17	0.21
3-13					0.12	0.98							0.06	0.12		
3-14							0.08	0.93							0.15	0.27
3-17							0.06	0.77							0.15	0.25
3-18				1.02	0.12	0.89						0.20	0.11	0.16		
3-20					0.13	0.88							0.2	0.21		
3-28				1.05	0.05	0.49						0.24	0.13	0.21		
3-29							0.08	0.52							0.12	0.21
3-31							0.08	0.54							0.18	0.26
4-1					0.08	0.59							0.32	0.34		
4-4					0.06	0.58							0.12	0.28		
4-7							0.05	0.58							0.28	0.43
4-11					0.01	0.41							0.23	0.26		
4-15			0.09	0.53	0.01	0.34					0.22	0.28	0.12	0.20		
4-16							0.03	0.51							0.28	0.40
4-18					0.25	0.03							0.38	0.27		

Date	$NO_2 + NO_3$ (mg/L as N)								Kjeldahl Nitrogen (mg/L as N)							
	1995		1996		1997		1998		1995		1996		1997		1998	
	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth
4-22					0.02	0.13							0.40	0.42		
4-23							0.09	0.24							0.30	0.56
4-25					0.01	0.08							0.18	0.21		
4-28							0.05	0.21							0.58	0.40
4-30			0.04	0.33							0.14	0.31				
5-2					0.03	0.18							0.25	0.28		
5-6					0.02	0.10							0.36	0.10		
5-8							0.05	0.11							0.42	0.42
5-9					0.07	0.12							0.37	0.45		
5-13					0.07	0.07							0.11	0.30		
5-15	0.01	0.094	0.06	0.09	0.04	0.06			0.20	0.2	0.52	0.53	0.30	0.42		
5-21					0.05	0.07							0.21	0.26		
5-30	0.035	0.05	0.09	0.14	0.06	0.07			0.30	0.4	0.3	0.50	0.12	0.30		
6-3					0.06	0.28							0.43	0.13		
6-11			0.05	0.10	0.04	0.06					0.24	0.33	0.17	0.19		
6-20	0.032	0.076			0.05	0.08			0.3	0.2			0.025	0.10		
6-26	0.026	0.066	0.04	0.11	0.03	0.10			0.20	0.6	0.22	0.37	0.37	0.27		
7-2					0.01	0.11							0.31	0.21		
7-9			0.028	0.157							0.27	0.23				
7-14					0.01	0.11							0.13	0.18		
7-18	0.021	0.088			0.01	0.10			0.10	0.10			0.17	0.18		
7-23			0.02	0.28							0.22	0.26				
7-31	0.0025	0.185							0.20	0.2						
8-5			0.04	0.47							0.15	0.19				

Date	$NO_2 + NO_3$ (mg/L as N)								Kjeldahl Nitrogen (mg/L as N)							
	1995		1996		1997		1998		1995		1996		1997		1998	
	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth
8-14	0.0025	0.038							0.06	0.19						
8-20			0.04	0.58							0.28	0.26				
8-28	0.02	0.615							0.34	0.18						
9-5			0.03	0.66							0.12	0.16				
9-11	1.18	1.94							0.18	0.23						
9-17			0.04	0.62							0.09	0.15				
9-25	0.55	1.65							0.50	0.66						
10-3			0.04	0.76							0.12	0.17				
10-12	1.23	1.73							0.90	0.20						
10-17			0.04	0.85							0.11	0.16				
10-23	0.41	1.04							0.14	0.09						
11-5	0.064	0.986	0.06	0.74					0.15	0.19	0.08	0.13				

Table K-2. Concentrations of total phosphorus in samples collected from the mouth of Bitch Creek and at the National Forest boundary.

	Total Phosphorus (mg/L as P)							
	1995		1996		1997		1998	
Date	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth
2-12							0.017	0.021
2-18					0.009	0.019		
2-19							0.017	0.029
3-1							0.0025	0.015
3-7							0.0025	0.013
3-13					0.012	0.02		
3-14							0.006	0.006
3-17							0.005	0.014
3-18				0.045	0.011	0.019		
3-20					0.024	0.023		
3-28				0.027	0.018	0.037		
3-29							0.022	0.028
3-31							0.016	0.024
4-1					0.02	0.04		
4-4					0.016	0.031		
4-7							0.02	0.03
4-11					0.02	0.03		
4-15			0.024	0.037	0.017	0.025		
4-16							0.029	0.034
4-18					0.048	0.035		
4-22					0.07	0.084		
4-23							0.086	0.086
4-25					0.032	0.063		
4-28							0.095	0.06
4-30			0.027	0.038				
5-2					0.021	0.033		
5-6					0.026	0.044		
5-8							0.03	0.088
5-9					0.042	0.072		
5-13					0.033	0.047		
5-15	0.025	0.035	0.084	0.13	0.063	0.086		
5-21					0.021	0.033		

	Total Phosphorus (mg/L as P)							
	1995		1996		1997		1998	
Date	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth
5-30	0.053	0.05	0.019	0.059	0.033	0.045		
6-3					0.043	0.051		
6-11			0.046	0.067	0.017	0.019		
6-20	0.098	0.038			0.013	0.013		
6-26	0.024	0.105	0.015	0.02	0.011	0.013		
7-2					0.016	0.01		
7-9			0.012	0.015				
7-14					0.007	0.0025		
7-18	0.054	0.019			0.0025	0.007		
7-23			0.011	0.013				
7-31	0.013	0.022						
8-5			0.009	0.012				
8-14	0.014	0.015						
8-20			0.03	0.021				
8-28	0.012	0.013						
9-5			0.009	0.014				
9-11	0.012	0.029						
9-17			0.006	0.012				
9-25	0.006	0.032						
10-3			0.008	0.013				
10-12	0.017	0.011						
10-17			0.01	0.016				
10-23	0.012	0.02						
11-5	0.009	0.016	0.007	0.014				

Table K-3. Concentrations of total suspended solids in samples collected from the mouth of Bitch Creek and at the National Forest boundary.

	Discharge (cfs)								Total Suspended Solids **(mg/L)**							
	1995	1995	1996	1996	1997	1997	1998	1998	1995	1995	1996	1996	1997	1997	1998	1998
Date	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth
2-12							14	24							2	2
2-18					26	36							1	2		
2-19							13	23							2	2
3-1							36	52							2	2
3-7							41	58							2	2
3-13					25	35							1	1		
3-14							37	53							2	2
3-17							15	24							2	2
3-18				45	40	56						1	3	1		
3-20					37	52							2	2		
3-28				59	58	80						1	6	4		
3-29							65	93							6	3
3-31							38	54							7	3
4-1					52	72							4	4		
4-4					45	55							1	2		
4-7							29	79							2	2
4-11					33	54							7	9		
4-15			68	131	48	63					5	8	3	3		
4-16							46	78							2	4
4-18					127	176							29	12		
4-22					96	134							35	12		
4-23							132	186							6	21
4-25					81	112							4	10		
4-28							204	288							2	2
4-30			125	219							10	5				
5-2					75	104							7	8		
5-6					78	109							6	11		
5-8							226	319							9	28

	Discharge (cfs)								Total Suspended Solids (mg/L)							
	1995	1995	1996	1996	1997	1997	1998	1998	1995	1995	1996	1996	1997	1997	1998	1998
Date	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth	Forest	Mouth
5-9					114	159							9	37		
5-13					180	250							15	22		
5-15	309	321	310	443	216	300			3	6	53	85	54	82		
5-21					257	357							18	24		
5-30	285	297	365	522	254	353			44	41	12	46	42	44		
6-3					313	435							52	64		
6-11			585	836	341	473					42	67	57	50		
6-20	262	271			276	384			17	14			46	66		
6-26	250	252	303	433	166	231			18	90	7	14	4	1		
7-2					144	200							6	6		
7-9			222	317							3	5				
7-14					116	161							2	2		
7-18	220	221			96	133			29	10			3	1		
7-23			132	181							3	4				
7-31	177	179							1	4						
8-5			93	107							1	1				
8-14	88	99							2	1						
8-20			57	66							10	4				
8-28	39	76							1	1						
9-5			49	65							1	1				
9-11	46	56							1	1						
9-17			50	62							1	2				
9-25	40	56							1	1						
10-3			37	45							1	2				
10-12	46	56							1	3						
10-17			25	31							1	1				
10-23	24	55							3	3						
11-5	20	54	22	32					2	2	1	1				

Appendix L. Concentrations of Nutrients in Samples Collected from the Teton River.

Table L-1. Concentrations of $NO_2 + NO_3$ or NO_3 in samples collected from the upper Teton River 1986 - 1990. Concentrations of $NO_2 + NO_3$ or NO_3 greater than 0.3 mg/L are highlighted with *italic* type.

Date	Teton River above Horseshoe Creek[1] $NO_2 + NO_3$ (mg/L as N)	Teton River at Highway 33 (Harrop's Bridge)[1] $NO_2 + NO_3$ (mg/L as N)	Teton River above Confluence of Milk Creek[2] NO_3 (mg/L as N)	Teton River below Confluence of Milk Creek[2] NO_3 (mg/L as N)	Teton River 0.1 mile above the Confluence of Canyon Creek[3] $NO_2 + NO_3$ (mg/L as N)	Teton River 0.2 mile below the Confluence of Canyon Creek[3] $NO_2 + NO_3$ (mg/L as N)
5/14/86				*0.519*		
6/11/86			0.141			
7/10/86				*0.455*		
4/6/87					*0.611*	*0.567*
4/14/87					*0.732*	*0.771*
5/5/87					*0.321*	0.289
5/29/87					0.226	0.233
7/7/87					*0.358*	*0.368*
10/25-26/88	*0.55*	*0.33A*[4]				
11/28-29/88	*0.58*	*0.43*				
2/27-28/89	*0.75*	*0.71A*				
3/13-14/89	*0.62*	0.314				
3/27-28/89	*0.58*	*0.42A*				*0.66*
4/10-11/89	*0.87*	*0.58A*				*0.57*
4/25-26/89	*0.86*	*0.60A*				*0.51*
5/30-31/89	*0.34*	*0.37*				*0.33*
6/12-13/89	0.13	0.15A				0.26
6/26/89						*0.39*
7/24-25/89	*0.52*	*0.50A*				*0.38*
2/20/90	*0.95*					
4/11-12/90	*0.58*	*0.35A*				*0.48*

Date	Teton River above Horseshoe Creek[1] NO$_2$ + NO$_3$ (mg/L as N)	Teton River at Highway 33 (Harrop's Bridge)[1] NO$_2$ + NO$_3$ (mg/L as N)	Teton River above Confluence of Milk Creek[2] NO$_3$ (mg/L as N)	Teton River below Confluence of Milk Creek[2] NO$_3$ (mg/L as N)	Teton River 0.1 mile above the Confluence of Canyon Creek[3] NO$_2$ + NO$_3$ (mg/L as N)	Teton River 0.2 mile below the Confluence of Canyon Creek[3] NO$_2$ + NO$_3$ (mg/L as N)
4/22-23/90	*0.44*	*0.22A*				0.25
5/16-17/90		0.05K[5]				0.005K

[1]Source: Drewes (1993) [2]Source: Drewes (1988) [3]Source for 1987 data: Drewes (1987); source for 1989-90 data: Drewes (1993).
[4]A: Represents average of more than one value. [5]K: Non-ideal analytical range.

Table L-2. Concentrations of orthophosphorus (ortho P) and NO_2 + NO_3 (mg/L as N) in samples collected from Teton River tributaries since 1988. Concentrations of NO_2 + NO_3 or NO_3 greater than 0.3 mg/L are highlighted with *italic* type.

	Fox Creek near Confluence with Teton River[1]		Horseshoe Creek near Confluence with Teton River[2]		Packsaddle Creek near Confluence with Teton River[2]		Spring Creek near Confluence with Teton River[2]		South Leigh Creek near Confluence with Teton River[2]	
Date	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)
10/25-26/88							0.001K[3]	0.001K		
4/25-26/89			0.006	0.10	0.016	0.06				
5/30-31/89			0.006	0.007	0.030	0.04	0.042	0.16	0.001K	0.03
6/12-13/89			0.001K	0.003	0.001K	0.002	0.001K	0.10	0.001K	0.09
6/26/89					0.001K	0.001K				
7/24-25/89							0.001K	0.16	0.001K	0.02
4/11-12/90			0.01	0.005K	0.033	0.005K				
4/22-23/90			0.005K	0.02	0.027	0.009				
5/16-17/90			0.007		0.015	0.005K	0.006	0.005K		
8/1/98	0.017	*0.85*								
6/99	0.009	*0.789*								
8/12/99	0.008	*1.192*								
10/3/99	<0.001	*1.154*								

[1]Source for 1998 data: Thomas *et al*. (1999); source for 1999 data: Minshall (2000)
[2]Source: Drewes (1993) [3]K: Non-ideal analytical range.

Table L-3. **Concentrations of orthophosphorus (ortho P) and NO_2 + NO_3 (mg/L as N) in samples collected from Teton River tributaries from 1986 to 1990. Concentrations of NO_2 + NO_3 or NO_3 greater than 0.3 mg/L are highlighted with *italic* type.**

	Badger Creek at Forest Boundary [1]		Bull Elk Creek at Confluence with Badger Creek[1]		Badger Creek at Confluence with Teton River[1]		Bitch Creek at Forest Boundary [1]		Bitch Creek at Confluence with Teton River[1]		Milk Creek at Highway 33[2]		Canyon Creek at Confluence with Teton River[3]	
Date	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)
4/29/86												0.081		
5/14/86												0.069		
5/28/86												0.006		
6/11/86												0.004		
6/25/86												0.010		
3/31/87													0.062	0.230
4/6/87													0.005	0.144
4/14/87													0.069	0.152
5/5/87													0.042	0.048
5/29/87													0.067[4]	0.074
7/7/87													0.017	0.100
10/25-26/88					0.007	*0.95*	0.005K[5]	*1.13*	0.001K	0.003				
2/28/89													0.009	0.04
3/27/89													0.001K	0.07
4/11/89													0.001K	0.11
4/25-26/89	0.005	0.25	0.029	*0.58*	0.011	*0.58*			0.010	0.28			0.022	0.18
5/30-31/89	0.003	0.02	0.017	0.06	0.004	0.29	0.006	0.03	0.001K	0.07			0.010	0.06
6/12-13/89	0.001K	0.006	0.026	0.03	0.001K	0.27	0.001K	0.04					0.001K	0.05
6/26/89									0.001K	0.08			0.003	*0.42*
7/24-25/89	0.001K	0.01			0.001K	*0.88*	0.002	0.001K	0.001K	0.24				

Date	Badger Creek at Forest Boundary[1]		Bull Elk Creek at Confluence with Badger Creek[1]		Badger Creek at Confluence with Teton River[1]		Bitch Creek at Forest Boundary[1]		Bitch Creek at Confluence with Teton River[1]		Milk Creek at Highway 33[2]		Canyon Creek at Confluence with Teton River[3]	
	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_3 (mg/L as N)	Ortho P (mg/L as P)	NO_2 + NO_3 (mg/L as N)
2/20/90	0.002A[6]	0.10A												
4/11-12/90	0.007	0.02	0.041	*0.51*	0.005K	*0.60*	0.010	0.03					0.023	0.005K
4/22-23/90	0.006	0.05	0.041	0.14	0.010	0.29	0.005 K	0.05					0.019	0.05
5/16-17/90	0.005K	0.005K	0.015	0.005K	0.005K	*0.50*	0.005K	0.005K					0.008	0.005K

[1]Source: Drewes (1993) [2]Source: Drewes (1988) [3]Source for 1987 data: Drewes (1987); source for 1989-90 data: Drewes (1993).
[4]A: Represents average of more than one value. [5]K: Non-ideal analytical range. [6]A: Represents average of more than one value

Appendix M. Determination of Temperature Criteria Violations in the Teton River Canyon.

1. The 90th percentile value for the maximum seven-day average air temperature was calculated using historical data available from the BOR AgriMet station at Rexburg. The maximum seven-day average air temperatures and the dates they occurred in 1987 through 2000 are listed in Table M-1.

Table M-1. Maximum seven-day average temperature.

Year	*MAXIMUM SEVEN-DAY AVERAGE TEMPERATURE*		Dates
	^{o} Celsius	^{o} Fahrenheit	
1987	29.8	85.6	July 24 – 30
1988	31.8	89.2	June 19 – 25
1989	33.3	91.9	July 25 – 31
1990	33.2	91.7	August 4 – 10
1991	31.4	88.6	August 8 – 14
1992	32.8	91.1	August 8 – 14
1993	27	80.6	September 5 – 11
1994	33.6	92.4	August 2 – 8
1995	30.4	86.7	August 22 – 28
1996	32.3	90.1	August 8 – 14
1997	31.5	88.7	August 20 – 26
1998	32.6	90.7	August 5 – 11
1999	30.4	86.7	August 17 – 23
2000	34.4	93.9	July 27 – August 2

The 90th percentile value based on these maximum seven-day average air temperatures is 33 ^{o}C (92.3 ^{o}F).

2. Three air temperature data loggers were deployed by the BOR in the canyon reach of the Teton River. Temperatures recorded by data loggers 2 and 9 exceeded 45 ^{o}C (113 ^{o}F), indicating that the loggers were directly exposed to sunlight and data were not representative ambient air temperatures. Data logger 7 was located in a tree at Spring Hollow and was apparently shaded from direct sunlight. The temperatures recorded by this data logger were therefore used to determine which dates the 90th percentile value for the maximum seven-day average air temperature was exceeded. These dates are highlighted in Table M-2, and indicate the dates when exceedances of cold water aquatic life temperature criteria are not considered violations of Idaho's water quality standards.

Table M-2. Data logger daily temperatures.

Date	High for Day		Low for Day		Average for Day	
	°C	°F	°C	°F	°C	°F
7/19/98	39.7	103.5	24.8	76.6	31.7	89.0
7/20/98	**34.4**	**93.9**	**19.8**	**67.6**	**24.7**	**76.4**
7/21/98	33.2	91.8	11.8	53.2	22.1	71.7
7/22/98	33.2	91.8	10.6	51.1	21.7	71.1
7/23/98	**34.9**	**94.8**	**15.6**	**60.1**	**23.2**	**73.8**
7/24/98	29.1	84.4	14.4	57.9	19.9	67.8
7/25/98	32.8	91.0	12.2	54.0	21.0	69.7
7/26/98	**35.3**	**95.5**	**11.8**	**53.2**	**22.0**	**71.6**
7/27/98	**36.6**	**97.9**	**15.6**	**60.1**	**23.6**	**74.4**
7/28/98	**33.6**	**92.5**	**12.9**	**55.2**	**21.2**	**70.2**
7/29/98	30.3	86.5	12.2	54.0	19.5	67.1
7/30/98	30.3	86.5	11.8	53.2	20.5	68.8
7/31/98	**34.9**	**94.8**	**11.4**	**52.5**	**18.9**	**66.1**
8/1/98	25.6	78.1	10.6	51.1	17.0	62.6
8/2/98	26.8	80.2	9.8	49.6	17.8	64.0
8/3/98	29.5	85.1	8.7	47.7	18.7	65.6
8/4/98	31.1	88.0	9.4	48.9	19.3	66.7
8/5/98	32.8	91.0	11.4	52.5	21.1	70.0
8/6/98	**34.9**	**94.8**	**11.4**	**52.5**	**22.9**	**73.1**
8/7/98	**33.6**	**92.5**	**13.3**	**55.9**	**22.4**	**72.4**
8/8/98	32.8	91.0	10.6	51.1	22.1	71.7
8/9/98	33.2	91.8	10.6	51.1	20.8	69.4
8/10/98	31.5	88.7	9.1	48.4	18.8	65.9
8/11/98	32.8	91.0	10.6	51.1	20.4	68.7
8/12/98	32.8	91.0	12.9	55.2	21.9	71.5
8/13/98	**33.6**	**92.5**	**11.4**	**52.5**	**21.4**	**70.5**
8/14/98	**33.6**	**92.5**	**12.2**	**54.0**	**21.6**	**70.9**
8/15/98	30.7	87.3	9.8	49.6	17.7	63.8
8/16/98	30.7	87.3	12.6	54.7	20.5	68.9
8/17/98	29.5	85.1	11.4	52.5	19.4	66.9
8/18/98	27.2	81.0	13.7	56.7	18.9	66.0
8/19/98	28.3	82.9	11	51.8	17.9	64.1
8/20/98	29.9	85.8	9.8	49.6	18.5	65.3
8/21/98	30.3	86.5	10.2	50.4	16.8	62.2
8/22/98	29.5	85.1	9.4	48.9	18.4	65.0
8/23/98	28.7	83.7	7.8	46.0	17.7	63.9
8/24/98	26.8	80.2	5.4	41.7	15.0	59.1
8/25/98	31.5	88.7	5.4	41.7	18.5	65.3
8/26/98	26.4	79.5	10.6	51.1	18.6	65.4
8/27/98	27.6	81.7	6.6	43.9	16.3	61.3
8/28/98	31.5	88.7	7.4	45.3	18.1	64.7
8/29/98	32.3	90.1	9.8	49.6	19.5	67.0
8/30/98	31.9	89.4	11	51.8	19.7	67.4
8/31/98	**33.6**	**92.5**	**10.2**	**50.4**	**20.2**	**68.4**
9/1/98	31.9	89.4	8.7	47.7	19.1	66.4

Date	High for Day		Low for Day		Average for Day	
	°C	°F	°C	°F	°C	°F
9/2/98	31.9	89.4	10.6	51.1	19.4	66.9
9/3/98	33.2	91.8	11.4	52.5	20.2	68.3
9/4/98	33.2	91.8	10.2	50.4	21.1	69.9
9/5/98	**34**	**93.2**	**13.7**	**56.7**	**21.7**	**71.0**
9/6/98	27.9	82.2	14.8	58.6	19.5	67.0
9/7/98	30.3	86.5	12.6	54.7	20.1	68.2
9/8/98	27.6	81.7	14.4	57.9	18.4	65.0
9/9/98	21.7	71.1	12.9	55.2	16.1	61.0
9/10/98	24.4	75.9	16.8	62.2	19.9	67.7